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NUCLEAR WASTE PROGRAM

HEARING

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

FIRST SESSION

ON

NUCLEAR WASTE GEOLOGIC SITING PROCESS

JUNE 29, 1987

PART 4

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NUCLEAR WASTE PROGRAM

MONDAY, JUNE 29, 1987

U.S. Senate,
Committee on Energy and Natural Resources,
Washington, DC.

The committee met, pursuant to notice, at 2:12 p.m., in room SD-366, Senate Dirksen Office Building, Hon. J. Bennett Johnston, chairman, presiding.

OPENING STATEMENT OF HON. J. BENNETT JOHNSTON, A U.S. SENATOR FROM THE STATE OF LOUISIANA

The Chairman. Today the Full Committee is continuing its oversight of the Department of Energy's program for disposal of spent fuel and high level radioactive waste in a geologic repository. At today's hearing we will hear from DOE officials who are the day to day managers of the repository projects in Nevada, Washington, and Texas. We will also hear from witnesses from the Nuclear Regulatory Commission.

The purpose of today's hearing is to focus on the status and completeness of the testing program developed by DOE to assess the suitability of these potential repository sites. Under the program mandated by the Nuclear Waste Policy Act of 1982, the Department was required to select three candidate sites for a repository for detailed characterization and testing. DOE selected the sites in Nevada, Washington and Texas in May 1986, and is now developing test programs for resolving technical issues at these sites.

A major part of these test programs will be the sinking of exploratory shafts beginning in 1988. These shafts are essential to get the necessary data and information on the suitability of the sites.

The Department of Energy has put a tremendous amount of work into the three first repository sites selected for characterization. We should continue this work.

Many people would like to shut down the entire nuclear waste program and go back and study the problem of nuclear waste disposal for the next several years. You might say study it forever. I believe that we would be neglecting our duty in Congress if we allowed that to happen.

The 1982 Waste Act was passed after many years of hard work. The process set out in the Act is a good one. We should allow that process to go forward. We have studied the problem enough. It is now time to solve it.

Today's witnesses will describe the major technical issues to be resolved at each site, and they will describe the planned testing programs for resolving these issues. Testimony will also address the Department's interaction with the Nuclear Regulatory Commission, the States, and affected Indian tribes in resolving technical and socioeconomic issues during the site characterization period.

Finally, let me say that it has been said that the Nuclear Waste Program is in disarray and needs to be stopped and started all over again. I think the record that we have made here in the past several hearings clearly belies that fact. The Nuclear Waste Program is never—repeat, never—going to satisfy a broad range of people, particularly many of those in whose backyards the waste is scheduled to be deposited. That does not mean the program is in disarray. That also does not mean the program is a perfect program and cannot be improved. I would hope, frankly, that we can improve the program as time goes on.

The way to improve the program is not to stop it, and to study it, and to start all over again. If I have anything to do with it, and I expect that I will, that simply will not happen. It would be highly irresponsible for this Congress to have a moratorium on the program and with some kind of study. If we did that, then there would be the question of who the studier is going to be, and we would argue that for months and we would not satisfy anybody. The study would be flawed from day 1 because they would never be able to satisfy the opponents of the program that we picked the right studiers, because what they want for studiers is somebody who will come up with a preordained conclusion which they agree with.

So, if I have anything to do with it, we are not going to do that.

I would like to put into the record a statement by Senator McClure, and call on my esteemed colleague from Nevada for such statement as he would like to make.

[The prepared statements of Senator Johnston and Senator McClure follow:]

STATEMENT OF SENATOR J. BENNETT JOHNSTON

CHAIRMAN, COMMITTEE ON ENERGY AND NATURAL RESOURCES

HEARING ON DOE'S PROGRAM FOR GEOLOGIC DISPOSAL OF NUCLEAR WASTE
JUNE 29, 1987

TODAY THE FULL COMMITTEE IS CONTINUING ITS OVERSIGHT OF THE DEPARTMENT OF ENERGY'S PROGRAM FOR DISPOSAL OF SPENT FUEL AND HIGH-LEVEL RADIOACTIVE WASTE IN A GEOLOGIC REPOSITORY. AT TODAY'S HEARING, WE WILL HEAR FROM DOE OFFICIALS WHO ARE THE DAY-TO-DAY MANAGERS OF THE REPOSITORY PROJECTS IN NEVADA, WASHINGTON, AND TEXAS. WE WILL ALSO HEAR FROM WITNESSES FROM THE NUCLEAR REGULATORY COMMISSION.

THE PURPOSE OF TODAY'S HEARING IS TO FOCUS ON THE STATUS AND COMPLETENESS OF THE TESTING PROGRAMS DEVELOPED BY DOE TO ASSESS THE SUITABILITY OF THESE POTENTIAL REPOSITORY SITES. UNDER THE PROGRAM MANDATED BY THE NUCLEAR WASTE POLICY ACT OF 1982, THE DEPARTMENT WAS REQUIRED TO SELECT THREE CANDIDATE REPOSITORY SITES FOR DETAILED CHARACTERIZATION AND TESTING. DOE SELECTED THE SITES IN NEVADA, WASHINGTON, AND TEXAS IN MAY 1986 AND IS NOW DEVELOPING TEST PROGRAMS FOR RESOLVING TECHNICAL ISSUES AT THESE SITES. A MAJOR PART OF THESE TEST PROGRAMS WILL BE THE SINKING OF EXPLORATORY SHAFTS BEGINNING IN 1988. THESE SHAFTS ARE ESSENTIAL TO GET THE NECESSARY DATA AND INFORMATION ON THE SUITABILITY OF THE SITES.

THE DEPARTMENT OF ENERGY HAS PUT A TREMENDOUS AMOUNT OF WORK INTO THE THREE FIRST REPOSITORY SITES SELECTED FOR CHARACTERIZATION. WE SHOULD CONTINUE THIS WORK.

MANY PEOPLE WOULD LIKE TO SHUT THE ENTIRE NUCLEAR WASTE PROGRAM DOWN AND GO BACK AND STUDY THE PROBLEM OF NUCLEAR WASTE DISPOSAL FOR THE NEXT SEVERAL YEARS.

I BELIEVE THAT WE WOULD BE NEGLECTING OUR DUTY IN CONGRESS IF WE ALLOWED THAT TO HAPPEN. THE 1982 WASTE ACT WAS PASSED AFTER MANY YEARS OF HARD WORK. THE PROCESS SET OUT IN THE ACT IS A GOOD ONE. WE SHOULD ALLOW THAT PROCESS TO GO FORWARD. WE HAVE STUDIED THE PROBLEM ENOUGH. WE MUST GO OUT AND SOLVE IT.

TODAY'S WITNESSES WILL DESCRIBE THE MAJOR TECHNICAL ISSUES TO BE RESOLVED AT EACH SITE AND THEY WILL DESCRIBE THE PLANNED TESTING PROGRAMS FOR RESOLVING THESE ISSUES. TESTIMONY WILL ALSO ADDRESS THE DEPARTMENT'S INTERACTION WITH THE NUCLEAR REGULATORY COMMISSION, THE STATES, AND AFFECTED INDIAN TRIBES IN RESOLVING TECHNICAL AND SOCIOECONOMIC ISSUES DURING THE SITE CHARACTERIZATION PERIOD.

OPENING STATEMENT - SENATOR JAMES A. McCLURE
JUNE 29, 1987, HEARING

Good afternoon. I'm grateful to the Chairman for giving the Committee this opportunity to gain additional insight into the status of first-repository siting activities: this time, from the perspective of the three site managers.

There are some Members of Congress, and some State spokesmen, who claim that the high-level waste program is hopelessly lost, and so mismanaged that we need to start over with a clean slate. While I might agree that certain events have thrown the program off balance, and tarnished the Department's image, I am not convinced that we should abandon the program. No matter how "clean" a slate we might start over from, and no matter how carefully we restructure the program, I guarantee you that, once we zero in again on specific sites in specific States, we will find ourselves in the exact same situation we are in today. There will be allegations of foul-play, accusations of technical and managerial transgressions, and all the rest. That is not the solution to our present dilemma.

I am more inclined to say that, so long as the experts (including NRC, EPA, NAS, and outside experts) agree that there are no technical reasons not to proceed with site characterization, and so long as these same experts agree that the only means to resolve the uncertainties is to perform detailed scientific investigations, then we must move forward. The question that remains, then, is "how do we proceed, and at what pace?" It is clear that the original milestones in the Act

CANNOT BE MET, AND IN FACT, DO NOT NEED TO BE MET. WE CAN PROCEED AT A MORE DELIBERATE PACE. WE CAN PROVIDE ALTERNATIVE MEANS FOR WASTE STORAGE IN THE INTERIM, WHILE WE MAKE EVERY EFFORT TO CARRY OUT THE SITE CHARACTERIZATION WORK IN A CREDIBLE, SCIENTIFICALLY SOUND MANNER.

WE HAVE BEFORE US TODAY THE PEOPLE WHO ARE CLOSEST TO THE WORK AT EACH OF THE THREE SITES IN NEVADA, TEXAS, AND WASHINGTON. WHILE THERE IS NO SUCH THING AS A COMPLETELY UNBIASED VIEW ABOUT THE HIGH-LEVEL-WASTE PROGRAM, I'M HOPING THAT TODAY'S WITNESSES CAN AT LEAST GIVE US A FRESH PERSPECTIVE ON THE STATUS AND PROGRAM PLANS AT EACH SITE. GENTLEMEN, I LOOK FORWARD TO YOUR TESTIMONY.

STATEMENT OF HON. CHIC HECHT, A U.S. SENATOR FROM THE STATE OF NEVADA

Senator HECHT. Thank you, very much, Senator. Again, I applaud your role on the of nuclear waste issue. We cannot throw up our arms in hysteria and say it is going to go away. It is not. The nuclear age is here. We have to handle nuclear waste with the different nuclear powerplants being built and that are in existence in America and the rest of the world.

As you mentioned in your opening remarks, just because we have a program there is no reason that we cannot make that better program. When we are talking about the health and safety of Americans and people all around the world, we have to be absolutely sure that we are going to have the finest program. That is the reason I applaud your trip to Sweden and to France, and we came back with these different suggestions which I think we are going to have to take upon MRS, cooling off period of perhaps 50 years before we move the waste, a recycling program, better transportation. I think we have to look into alternatives such as the subseabed which we looked at in Sweden where they do a very, very good job. These are just some thoughts to make our program better and I wanted to give them to you today.

The CHAIRMAN. Thank you, Senator Hecht, and I wanted to commend you for the hard work you have put in on this question of nuclear waste. You have been with us on our trips to Sweden. You have made good suggestions, constructive suggestions. You have gotten to be very knowledgeable on the subject, unlike some critics who do not want to know about the program. They just want to criticize. You have not done that. You have been very involved with the process and played a very constructive role, and I think all of us on the committee appreciate it.

Senator HECHT. Thank you.

The CHAIRMAN. Now we have a panel consisting of Mr. Stephen H. Kale, Associate Director of the Office of Geologic Repositories, Office of Civilian Radioactive Waste Management of the Department of Energy; Mr. John H. Anttonen, Project Manager of the Basalt Waste Isolation Project at the Richland operations of DOE; Mr. Donald L. Vieth is the Director of Waste Management Project Office in the Nevada Operations of DOE; Mr. Jeff O. Neff is Manager of the Salt Repository Project Office of DOE in Columbus, Ohio.

Gentlemen, we are pleased to have you today. Your statements will go into the record. If you would like to summarize, that would be fine, but proceed as you wish. First would be Mr. Kale.

STATEMENT OF STEPHEN H. KALE, ASSOCIATE DIRECTOR, OFFICE OF GEOLOGIC REPOSITORIES, OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT, DEPARTMENT OF ENERGY

Mr. KALE. Mr. Chairman, Members of the Committee, my name is Stephen Kale, and I am the Associate Director for Geologic Repositories in the Office of Civilian Radioactive Waste Management. I appreciate the opportunity to appear before you today to discuss activities related to site characterization of candidate sites for the

Nation's first geologic repository for spent fuel and high level radioactive waste.

With me are the project managers for each of the three sites. These gentlemen will provide you with summaries of their testimony concerning key topics at each of their sites. Before I introduce them I would, however, like to very briefly summarize the status of our work for the first repository.

Following the President's approval May 28, 1986, of the Secretary's recommendations of the sites for characterization at Yucca Mountain, Nevada, Deaf Smith County, Texas, and Hanford, Washington, technical planning work specific to the three sites entered in advance stage. The most prominent of the many major tasks which faced us was, and still is, the preparation of the three site characterization plans. These plans have been under development for over two years. They are being prepared by the three project offices in close collaboration with my staff.

In their individual remarks, the project managers will provide you with a description of the progress that has been made for each characterization plan and will explain how we are addressing the many technical issues confronting us at each site.

There are four purposes of site characterization, phase of the waste program which began with the President's approval of three sites. One is to collect and analyze the extensive, complex geologic and environmental data necessary to evaluate the suitability of a site for development as a repository.

Secondly, to develop site specific designs both for the repository and for the waste package being placed in the repository.

Third, to prepare an environmental impact statement and, fourth, to develop the information necessary to receive a construction authorization for a repository from the U.S. Nuclear Regulatory Commission.

Because of the various stages of activities of each site, activities will not be entirely in parallel. Site characterization will require five to seven years depending on the site. It will consist of surface-based field studies, construction of an exploratory shaft facility, and the detailed tests conducted below surface in that facility.

I believe it is important to point out that site characterization is a non-radiological activity. That is to say no radioactive waste will be introduced to any one of the three candidate facilities until a site is selected and approved by the President, a construction authorization is received from the NRC, the repository is constructed, and DOE begins receiving spent fuel and high level waste for disposal.

For those candidate sites not selected, approved and licensed as a repository, DOE will restore the site to the original condition as required by the Nuclear Waste Policy Act of 1982. The NWPA requires that prior to sinking shafts at any candidate site, that DOE make the plan initially available to the public, and that DOE hold public hearings in the vicinity of the candidate site to inform the residents of the area of the plan to receive their comments.

The site characterization plans are, thus, key technical planning documents and are of major importance to the States, Indian tribes, and the public, as well as, of course, to the NRC, and to us at DOE. The SCPs will provide a thorough status of what is known about the site, describe the conceptual designs for the repository and waste package, identify necessary additional information requirements, and present plans for obtaining all the information needed to support siting, licensing, and design.

DOE is currently engaged in intensive development and review of the SCPs for each of the three sites. The development is proceeding extremely well and is leading to high quality documents which will carefully detail the logic for the data collection and evaluation procedures necessary to assure careful and thorough site characterization.

As the draft chapters become available they are being provided to the States and Indian Tribes. As characterization proceeds, six month updates or progress reports of the SCPs will be issued to keep current the documentation of the test program.

I would now like to introduce the project managers. Immediately to my right is Mr. John Anttonen who is project manager for the Hanford site in Washington. With your concurrence, Mr. Chairman, he will speak first. He will then be followed by Mr. Donald Vieth, who is project manager for the Yucca Mountain site in Nevada. Mr. Veith will be followed in turn by Mr. Jefferson O. Neff, who is project manager for the Deaf Smith County site in Texas.

Each of these gentleman has prepared detailed statements which we request be submitted for the record, and at this time they will briefly summarize their statements. Thank you, Mr. Chairman, and as we proceed, our project managers and I are prepared to address your questions or those of the other committee members.

[The prepared statement of Mr. Kale follows:]

STATEMENT OF

STEPHEN H. KALE
ASSOCIATE DIRECTOR
OFFICE OF GEOLOGIC REPOSITORIES
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

U.S. DEPARTMENT OF ENERGY

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

JUNE 29, 1987

Mr. Chairman and Members of the Committee:

I appreciate the opportunity to appear before you today to discuss activities related to site characterization of candidate sites for the Nation's first geologic repository for spent fuel and high-level radioactive waste. With me are the Project Managers for each of the three sites; these gentlemen will provide you with testimony concerning key topics at each of their sites.

Before I introduce them, I would like to very briefly summarize the status of our work on the first repository.

Following the President's approval May 28, 1986, of the Secretary's recommendation of the sites for characterization at Yucca Mountain, Nevada; Deaf Smith County, Texas; and Hanford, Washington, technical planning work specific to the three sites entered an advanced stage. The most prominent of the many major tasks which faced us was, and is, the preparation of the three Site Characterization Plans. These plans have been under development for over two years. They are being prepared by the three project offices in close collaboration with my staff. In their individual remarks, the Project Managers will provide you with a description of the progress that has been made for each Site Characterization Plan and will explain how we are addressing the many technical issues confronting us at each site.

There are four purposes of site characterization, a phase of the waste program which began with the President's approval of three sites: (1) to collect and analyze the extensive and complex geologic and environmental data necessary to evaluate the suitability of a site for development as a repository; (2) to develop site-specific designs both for a repository and for the waste package to be emplaced in the repository; (3) to prepare an environmental impact statement; and (4) to develop the information necessary to receive a construction authorization for a repository from the U.S. Nuclear Regulatory Commission (NRC).

Because of the various stages of activities at each candidate site, activities will not be entirely in parallel. Site characterization will require five-to-seven years, depending on the site. It will consist of surface-based field studies, construction of an exploratory shaft facility and the detailed tests conducted below surface in that facility.

I believe it is important to point out that site characterization is a non-radiological activity. That is to say, no radioactive waste will be introduced into any one of the three candidate facilities until a site is selected and approved by the President, a construction authorization is received from the Nuclear Regulatory Commission, the repository is constructed and DOE begins receiving spent fuel and high-level waste for disposal. For those candidate sites not selected, approved and licensed as a repository, DOE will restore the site to the original condition, as required by the Nuclear Waste Policy Act of 1982 (NWPA).

The NWPA requires that, prior to sinking shafts at any candidate site, DOE make the plan initially available to the public, and that DOE hold public hearings in the vicinity of the candidate site to inform the residents of the area of the plan and to receive their comments.

The Site Characterization Plans (SCP's) are key technical planning documents and of major importance to the States, Indian Tribes, and the public--as well as to the NRC and to us at DOE.

The SCP's will provide a thorough status of what is known about the site, describe the conceptual designs for the repository and the waste package, identify necessary additional information requirements and present plans for obtaining all such information needed to support siting, licensing, and design. DOE is currently engaged in intensive development and review of the SCP's for each of the three sites. The development is proceeding extremely well and is leading to high quality documents which will carefully detail the logic for the data collection and evaluation procedures necessary to assure careful and thorough site characterization. As the draft chapters become available, they are being provided to the States and Indian Tribes. As characterization proceeds, six-month updates of the SCP's will be issued to keep current the documentation of the test program.

I would now like to introduce the Project Managers. Since we generally address the candidate sites in alphabetical order by State, I will introduce our Project Managers as such. Mr. Donald Vieth is Project Manager for the Yucca Mountain site in Nevada. With your concurrence he will speak first. He will be followed by Mr. Jefferson Neff who is Project Manager for the Deaf Smith County site in Texas. Mr. Neff will then be followed in turn by Mr. John Anttonen, Project Manager for the Hanford site in Washington.

Thank you, Mr. Chairman. I would be happy to answer any questions you may have. And as we proceed, our Project Managers and I are prepared to address your questions or those of other Committee members as you wish.

STATEMENT OF JOHN H. ANTTONEN, PROJECT MANAGER, BASALT WASTE ISOLATION PROJECT, RICHLAND OPERATIONS OFFICE, DEPARTMENT OF ENERGY

Mr. ANTTONEN. Thank you, Steve. Mr. Chairman, members of the committee, I appreciate the opportunity to appear before you this afternoon to discuss the Basalt Waste Isolation Project. My name is John Anttonen, and I am the project manager of the Basalt Waste Isolation Project. My responsibilities are to manage the day-to-day activities of the project which is located at the Hanford site.

I will summarize briefly my written testimony, and then I will be happy to answer any questions you might have. The topics I would like to cover today are, first, a little history of the site, talk a little bit about the site specific technical issues, talk about current project status, and then talk a little about institutional interactions.

History. In the 1950s, a panel of National Academy of Sciences began studying the problem of how to dispose of radioactive nuclear waste. Ultimately, deep geologic disposal was agreed upon as a preferred method.

During the 1960s and the 1970s, the Atomic Energy Commission considered recommendations for long-term storage in disposal of defense waste at Hanford, including considerations of storage in the basalt formations that underlie the site. A number of bore holes were drilled on the site, along with an existing deep bore hole adjacent to the site for use to assess the basalt's underlined site.

Analysis of the data from the core samples resulted on preliminary data on geology beneath the site. In 1976, the Nuclear Waste Terminal Storage Program was established and additional studies were completed on the capability of the basalt at Hanford to isolate radioactive waste from the environment.

In 1978, the Basalt Waste Isolation Project was established and a site identification study was started to identify a preferred site at Hanford. Screening of potential basalt sites at Hanford was completed in 1980, and a reference repository location was identified. A site for exploratory shaft facility was selected in 1982, with plans to start drilling an exploratory shaft in February of 1983.

Through 1983, approximately $200 million was spent evaluating the site. When the Nuclear Waste Policy Act of 1982 was passed, BWIP was prepared to begin drilling an exploratory shaft. However, the Department concluded that BWIP should be consistent with the activities of the other candidate sites and elected not to initiate drilling until site selection process leading to a detailed site characterization had been completed, and only if Hanford was among the selected sites.

Next I will cover site specific technical issues including hydrology of the Hanford basalt, geology in the reference repository location, and repository constructability.

The basalt rock that is the focus of our studies is located approximately 3,200 feet deep. The rock is below the water table and is saturated. Understanding how this very deep groundwater system operates is one of the key issues of the project. We have preliminary information to date, but we need more information to determine both the direction and rate of water movement at depth. This information will be collected during site characterization. Since this is a key issue, we are meeting with project participants to come to an agreement on the hydrology testing approach and the methods to be used. I might say that we have already reached tentative general agreement on the hydrology program required prior to sinking the exploratory shaft.

We must also understand the geology of the region. The basalt below the site is millions of years old and was formed by floods of liquid rock that eventually cooled to a solid formation. Seventy individual layers have been identified and range between 30 and 300 feet in thickness. The particular flow that we are looking at for a repository is the Cohasset flow, which is approximately 250 feet thick.

Previous investigations of the site have shown that the region around the Hanford site has low to moderate potential for earthquake and is tectonically quite stable. The area appears to have a very slow deformation rate which has been ongoing for approximately 20 million years. This deformation causes high stresses in the underformed rock, which must be quantified and understood, to be sure that the repository tunnels deep underground will remain stable and safe to work in during construction and operation for a repository.

Future investigations must provide the geologic evidence needed to formulate models of how the area will be altered over the years by the geologic movement. Also, we must develop a complete picture of earthquake potential and possible impacts expected during and after repository construction, operation, and closure.

Construction of the exploratory shaft facility will provide the information necessary to assess and resolve constructability questions, and provide data needed for design of the facility.

The site characterization phase officially began on May 28, 1986, with presidential approval of the BWIP site. Since that time BWIP has been working on the preparation of a site characterization plan, and this effort is nearing completion. This document will discuss two basic topics. First, what is known about the site today. Second, what the testing program will be over, the course of detailed site characterization. We expect to issue the plan to the Nuclear Regulatory Commission and for formal public review and comment later this year.

After the plan has been reviewed and comments received, sinking of the exploratory shaft could proceed. In the meantime, ongoing and critical activities are proceeding based on preliminary plans.

Construction of the exploratory shaft facility is the next major activity following finalization of the site characterization plan. Before the work can proceed, we must complete some major hydrologic testing to obtain data on the conditions that can be disturbed by construction of the exploratory shaft. In recent months we have developed plans and conducted discussions with program participants regarding the pre-exploratory shaft hydrology program.

As I indicated previously, we have reached tentative agreement on many of the major aspects of the testing program. We are continuing to work on that phase of the characterization process.

On May 1, 1986, the Department, my office, issued a stop work order to the integrating contractor to assure that technical and business management controls were in place. A partial lift of the stop work was issued this month on June 10th. At this time work is proceeding under controlled conditions. A full lifting of the stop work order will occur later this year.

The final topic is institutional interactions of the project. For our project, the State of Washington, and the three affected Indian tribes, the Yakima Indian Nation, the Confederated tribes of the Umatilla Indian reservation, and the Nez Perce Tribes are actively involved in monitoring the program and providing comments on a regular basis.

BWIP conducts quarterly meetings with the participants to update them on program status and activities. The BWIP division manager meets weekly with NRC and tribal on-site representatives and representatives of the State of Washington to discuss status and issues relative to the project. I personally sit down monthly with the States and Tribes program managers to go over the status of the project and again discuss the issues.

In addition, the States and Tribes participate in all project technical meetings with the NRC, and these meetings are open to the public and to the media. Furthermore, topical meetings have been held and will continue to be held at the request of the states and tribes.

We feel that through this approach we have developed a sound working relationship with the participants.

The CHAIRMAN. Let me cut you off at that point. I have read your statement and we would like to ask some questions which your statement provokes.

[The prepared statement of Mr. Anttonen follows:]

STATEMENT OF

JOHN H. ANTTONEN, PROJECT MANAGER

BASALT WASTE ISOLATION PROJECT

U.S. DEPARTMENT OF ENERGY

RICHLAND OPERATIONS OFFICE

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES

UNITED STATES SENATE

JUNE 29, 1987

Mr. Chairman and Members of the Committee:

My name is John Anttonen and I am the Project Manager for the Basalt Waste Isolation Project (BWIP) at the Department's Richland Operations Office. The responsibilities of my office are to manage the day-to-day activities of the site suitability investigations of the basalt formations at the Hanford Site, a Department complex that is involved in a variety of national missions, including defense materials production, nuclear energy research, and radioactive waste management.

In my prepared comments today I would like to touch upon four specific subject areas relating to the BWIP program and then I would be happy to answer any questions you might have. The topics I will cover are: (1) historical aspects; (2) site specific technical issues and how they will be addressed during site characterization of the basalt site at Hanford; (3) current project status and; (4) institutional interaction. For clarity, I have attached several charts to my statement.

Historical Aspects

In the 1950's, a panel of the National Academy of Sciences (NAS) began studying the problem of how to dispose of radioactive nuclear waste. Ultimately, deep geologic disposal was agreed upon as the preferred method.

During the 1960's and 1970's, the Atomic Energy Commission, a predecessor to the Department, Hanford contractors, the international scientific community, the National Academy of Sciences (NAS), and later the Nuclear Regulatory Commission and DOE conducted sessions to consider recommendations for long-term storage and disposal of defense wastes stored on the Hanford Site. A number of boreholes were drilled on the site and, along with an existing deep borehole at the Site, were used to assess the basalt flows underlying the site. Analysis of the data from the core samples collected provided a methodology for identifying basalt flows deep below the surface and resulted in development of a map of the geology beneath the Hanford Site. (See Attachment A)

In 1976, the National Waste Terminal Storage Program was formally established to consider terminal storage of commercial radioactive wastes and funded a study to further review and evaluate the work done at Hanford on the basalt flows. A year later, studies were completed on the capability of the basalts at Hanford to isolate radioactive waste from the environment. The findings reinforced earlier conclusions that basalt was a potential media for the isolation of radioactive wastes.

In 1978, the National Waste Terminal Storage Program was restructured and expanded to meet the specific needs of commercial waste management. As part of this expanded program, the Basalt Waste Isolation Project was established and a site identification study was started to identify a preferred site for a nuclear waste repository in the basalts at Hanford. Also, research efforts were carried out relative to groundwater content and movement within the basalts, seismic characteristics of the site, depth and consistency of candidate basalt flows, and other factors that would weigh on the potential for using the Hanford Site for a repository.

Screening of potential basalt sites at Hanford was completed in 1980, and the Reference Repository Location was identified as a preferred site at Hanford. A site for construction of an Exploratory Shaft Facility was selected and authorization was given to construct the principal borehole for the shaft in 1982. (See Attachment B)

Following passage of the Nuclear Waste Policy Act by Congress in 1982, the character of the program changed. The Hanford Site was one of nine sites identified as a potentially acceptable site for the first geologic repository.

Although at the time of passage of the Act BWIP was prepared to begin drilling an exploratory shaft, the Department concluded that BWIP should be consistent with the activities at the other candidate sites. DOE elected not to initiate drilling of an exploratory shaft until the candidate site selection process leading to detailed site characterization had been completed and only then if Hanford was among the selected sites. The process included issuance of siting guidelines, preparation and issuance of the draft and final environmental assessments on each of the candidate sites and the Presidential site characterization decision of May 1986.

Site Specific Technical Issues and How They Will be Addressed

In preparation for drilling the exploratory shaft in 1982, and in accordance with NRC regulations, a Site Characterization report was prepared and issued. This report documented what was known about the site and defined the plans for investigating the site to determine whether it was suitable for a repository. That report received critical review by the NRC, the USGS, the State of Washington, the scientific community and others. Through consideration of these comments and subsequent reviews, a consensus has been reached relative to the issues that need to be addressed if the site at Hanford is to be considered suitable for a repository. The BWIP Site Characterization Plan, which we expect to distribute for review and comment later this year, will detail the specifics of how we will address the technical issues.

The major issues raised by States, affected Indian Tribes and the DOE technical community that I would like to discuss today are: Hydrology of the Hanford basalt; Geology in the Reference Repository Location; and repository constructability.

o The hydrology of the Hanford basalt:

The basalt flow that is the focus of our studies is located about 3,000 deep. The rock is below the water table and is saturated. Understanding how this very deep groundwater system operates is one of the key technical issues for BWIP.

To determine the direction and rate of water movement in the deep underground, we will conduct multiple tests, including large scale testing that will measure the hydraulic properties of the rock over several miles. This type of testing will provide information about possible and likely flow paths for groundwater. Other smaller scale tests will provide the statistical data we will need on rock and water properties to better understand the changes in rock properties throughout the site.

Hydrologic testing in the Exploratory Shaft Facility will give specific information about the properties of the actual layer of rock that would house a nuclear waste repository. The testing will give specific information on the vertical movement of water away from the repository. We are meeting with project participants to come to an agreement on the hydrology testing approach and the methods to be used. We have already reached general agreement on testing required before sinking the exploratory shaft.

- Geology in the Reference Repository Location:

Since the repository must be capable of performing for thousands of years, we must understand the geology of the region so that future changes would not be likely to provide a pathway for release of the radioactive materials to the environment.

The basalt beneath the site is millions of years old and was formed by floods of liquid rock that eventually cooled to a solid. Over 70 individual layers have been identified and range between 30 and 300 feet in thickness. The particular flow we are looking at is the Cohassett flow which is about 250 feet thick and approximately 3,000 feet below the surface.

Previous investigations of the site have shown that the region in and around the Hanford Site has low-to-moderate potential for earthquakes and is tectonically quite stable. The area appears to have a very slow deformation rate in the hills and small mountains in the region, which has been ongoing for approximately 20 million years. Investigations based on deep and shallow borehole information, exploratory shaft testing and other work will provide the geologic evidence we need to formulate models of how the area will be altered over the years by the geologic movement.

We will also do extensive work on seismic aspects of the geology to develop a complete picture of earthquake potential and the possible impacts we could expect during and after repository construction, operations, and closures.

- Repository Constructability:

As I indicated earlier, the region around Hanford is experiencing slow, ongoing geologic deformation. This deformation causes relatively high stresses in the undeformed rock in the region we are investigating. This state of stress in the rock must be quantified and understood to assure that the repository tunnels deep underground will remain stable and safe to work in during construction and operation of a repository.

The construction of the Exploratory Shaft Facility to investigate the deep basalts will provide information necessary to assess and resolve constructability questions and provide data needed for design of the facility. Testing in basalt at the Near Surface Test Facility tunnels in a basalt outcropping at Hanford has provided valuable information for the design of a repository.

This information will be confirmed in the Exploratory Shaft Facility and additional data obtained to optimize the repository design.

Current Project Status

During the investigation phase of BWIP leading up to the current site characterization phase, significant information has been developed, including:

- Geologic and hydrologic information obtained from surface and borehole investigations.
- Seismic and tectonic information from surface and borehole instrumentation.
- Rock mechanic information from laboratory and thermal-mechanical testing at the Near Surface Test Facility.
- Waste form performance and release rates from radioactive and non-radioactive waste form-basalt rock-groundwater interaction tests.
- Conceptual designs for the waste package and a repository in basalts.
- Performance models and assessments of potential waste package and repository releases.

Although this information is preliminary, it does form a good basis for establishing the program necessary for developing technical conclusions regarding the suitability of a repository at Hanford for isolating nuclear waste from the accessible environment.

For the past two years, BWIP has been working on the preparation of a Site Characterization Plan (SCP) and this effort is nearing completion. Work on the Plan has escalated during the past year and occupies much of our efforts today. The Plan, as I indicated before, will be the master plan for conducting detailed site characterization at the Hanford Site. The document will discuss two basic topics: What is known about the site today based on all the testing conducted to date, and what the testing program will be over the course of detailed site characterization. We expect to issue the Plan to the NRC and for formal public review and comment later this year. After the Plan has been reviewed and comments received and resolved, sinking of the exploratory shaft may proceed. In the meantime, ongoing and critical path activities are proceeding, based on preliminary plans.

Construction of the Exploratory Shaft Facility is the next major activity following finalization of the SCP. But before that work can proceed, we must complete some major hydrologic testing to obtain data on conditions that would be disturbed by construction of the Exploratory Shaft Facility. In recent months, we have developed plans and conducted discussions with program participants regarding the pre-exploratory shaft hydrology program. As I indicated previously, we have reached agreement on many of the major aspects of the testing program. We are continuing work on that phase of the characterization process.

During the past year, BWIP has focused on quality assurance and management issues which are necessary for large NRC licensed projects. In May 1986 the Department issued a Stop Work Order to the integrating contractor because of problems in these areas. Upgrades have been implemented and a partial lift of the Stop Work Order was issued this month. At this time, work is proceeding under controlled conditions. A full lifting of the Stop Work is expected later this year.

Institutional Interactions

The Nuclear Waste Policy Act of 1982 identified how affected States and Indian Tribes would be involved in the siting process for a high-level radioactive waste repository, as well as other agencies with an interest in the program. Sections 116 and 117 of the Act identify the interactions required by the Department. BWIP has been very active in this regard and we have worked extremely hard to include the participating groups in all steps of the process.

For BWIP, the States of Washington and Oregon, and the three affected Indian Tribes--the Yakima Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation and The Nez Perce Tribe--are actively involved in monitoring the program and providing comments on a regular basis. This has included regular briefings for the State of Washington since 1983. In addition, we have initiated similar briefing schedules for the affected Indian Tribes.

The formal briefings cover current topics of interest to the participants and allow us to keep them up to date on the status of the project and what to expect as each element moves through the preparation process and into implementation. An example of this is the Site Characterization Plan currently being written.

As portions of the Plan are completed in advance draft form, copies are being provided to the participants, and explained as requested, so they may review the material in a timely manner.

I would like to expand on the interactions we conduct with the affected parties. BWIP conducts quarterly meetings with the participants to update them on program status and activities and the BWIP Division Manager meets weekly with the NRC and Tribal on-site representatives, and representatives of the State, to discuss and resolve pending issues relevant to the program. I personally sit down monthly with the States' and Tribes' high-level radioactive waste program managers to go over the status of the program and, again, discuss the issues. In addition, the States and Tribes participate in all project technical meetings with the NRC and these meetings are open to the public and media. Furthermore, topical meetings have been held and will continue to be held at the request of the States and Tribes. We feel that through this approach we have developed a sound working relationship with the participants.

To facilitate timely and easy access to the BWIP process, we have worked with the affected Indian Tribes to provide for an on-site representative who has access to my staff and the contractor staff, and to the study zones on the Hanford Site. The State of Washington is working toward having an on-site representative at Hanford as well. The complexity of the project requires on-site access and we welcome the opportunity to provide such service.

The Act, under section 116, allows for financial assistance to the affected States and Indian Tribes in the form of grants. The grants are designed to assist the affected parties in reviewing the program to determine potential economic, social, public health and safety, and environmental impacts of a repository on the State, Indian lands or the residents. BWIP has responsibility for grant awards to affected parties connected with our project.

The following is a list of the grantees and the level of funding. This represents the cumulative totals through Fiscal Year 1986. Attachment C provides a brief description of the scope of each grant.

- The State of Washington Department of Ecology - $10.3 million.
- The State of Washington's Legislature - $1.5 million.
- The State of Oregon - $.5 million
- The Yakima Indian Nation - $5.8 million
- The Confederated Tribes of the Umatilla Indian Reservation - $2.8 million
- The Nez Perce Indian Nation - $2.9 million

Since 1983, BWIP has granted $23.8 million in grants to affected parties for conducting their oversight programs. Let me point out here that the scope of involvement ranges through a variety of institutional and technical areas, including but not limited to policy review, technical review, public involvement, legislative information, and direct interaction with DOE and the Richland Operations Office and project contractors.

The proximity of the Columbia River to the Hanford Site and its eventual flow west along the northern Oregon border have generated considerable interest on the part of that state. Oregon, while not having direct affected status under the Act, nevertheless is an interested party. As mentioned earlier, to facilitate their involvement in the program, DOE is currently providing $500,000 a year in funding for five years under a separate Congressional budget authorization. As such, we include Oregon as a project participant and consider their comments and concerns to be important to the BWIP program.

Seeking to negotiate Consultation and Cooperation (C&C) Agreements is spelled out as a requirement in the Nuclear Waste Policy Act, and BWIP has initiated "C&C" discussions with the affected parties. We have been negotiating "C&C" agreements with the State of Washington since 1983. Tribal discussions began in 1983 with the Yakima Indian Nation and with the Confederated Tribes of the Umatilla Indian Reservation in 1985. Discussions with the Nez Perce Tribe began this month.

The Nez Perce Indian Tribe is the only affected party with which we are currently negotiating a C&C agreement; however, offers to resume negotiations have been extended to all affected parties.

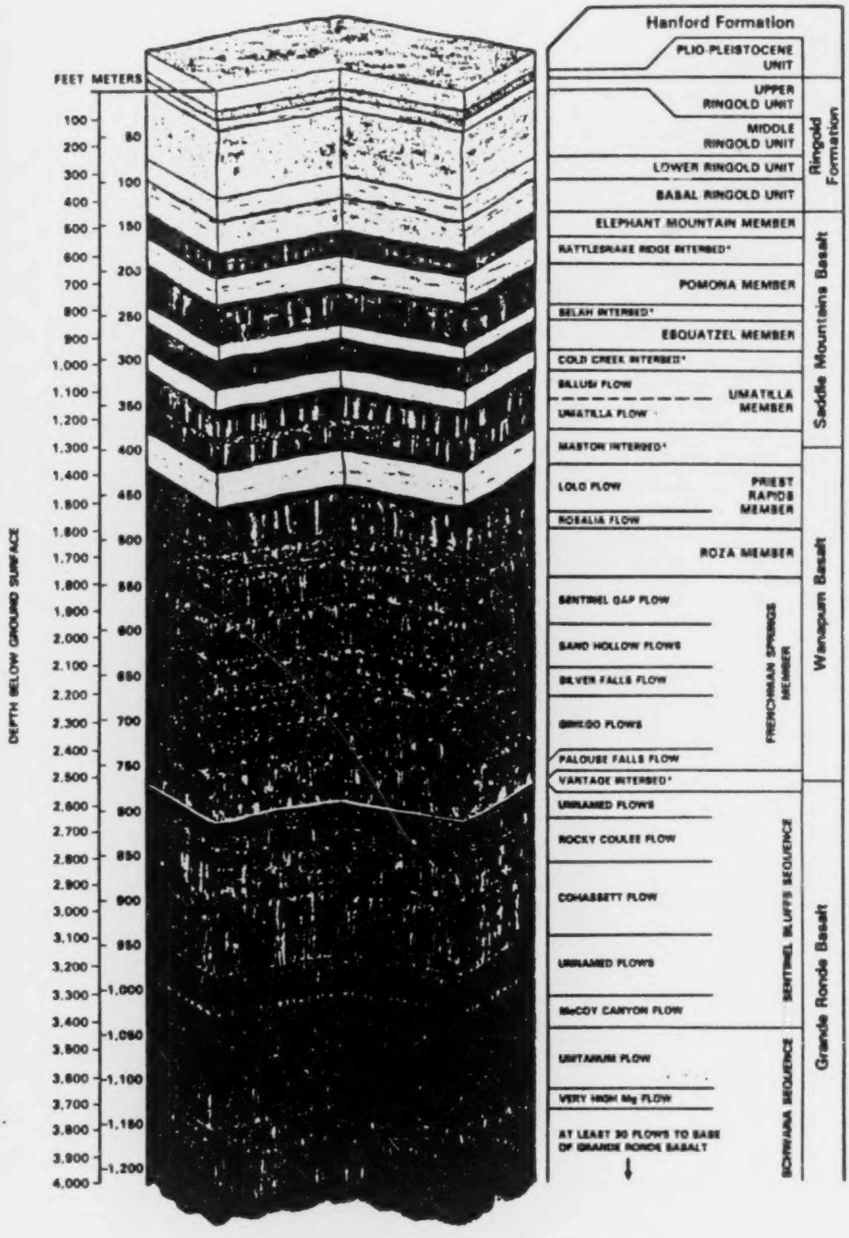
The public's involvement is also important to the site characterization and selection process. When the draft Environmental Assessments were issued in December 1984, the Department followed up early in 1985 with a series of public meetings throughout the northwest to receive comments. In the two years following, we have conducted a large number of public interactions, including site tours at Hanford for governmental officials, the media and the general public. Our speakers bureau has been very active in both Washington and Oregon, presenting the program in a variety of public settings.

When the Site Characterization Plan is issued, our public interactions will increase. In conjunction with formal release of the plan for public review and comment, we will be scheduling a series of workshops and formal public hearings to explain the Plan, discuss it with interested parties and receive their input for inclusion in the Plan updates which will be issued semi-annually.

This concludes my statement. I would be happy to answer any questions you may have about the BWIP project.

Attachment A

K8601-3.8


FEET
METERS
DEPTH BELOW GROUND SURFACE
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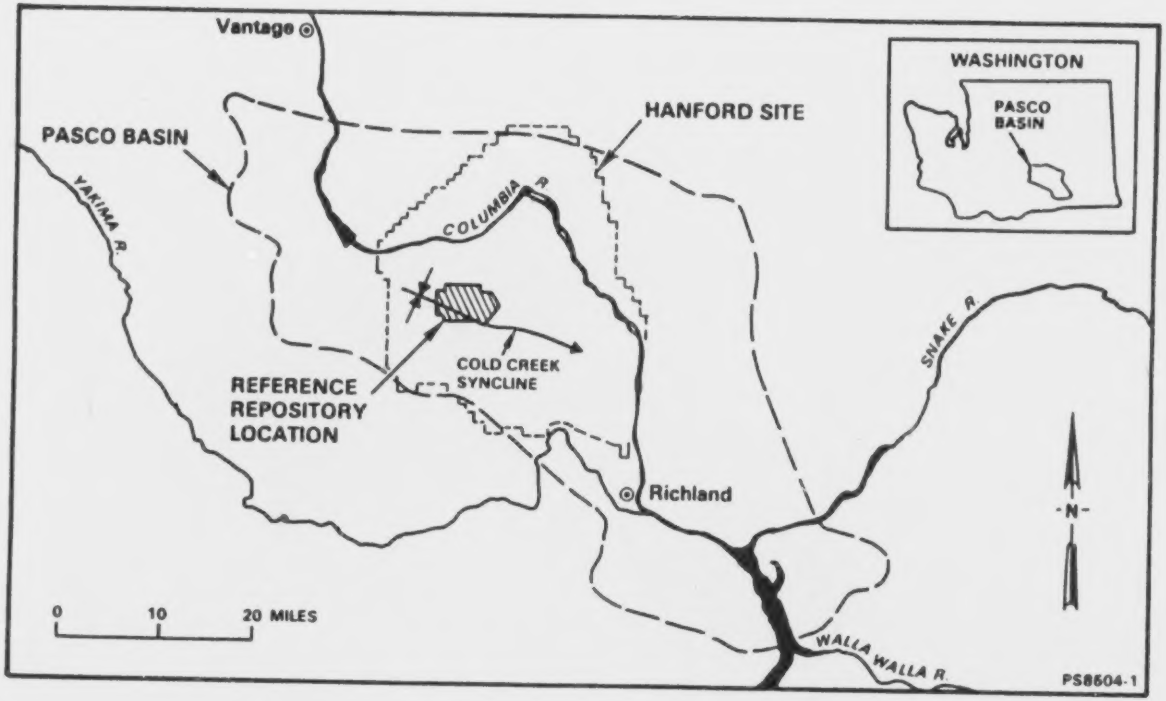
1,100
1,150
1,200
Hanford Formation
PLIO-PLEISTOCENE UNIT
UPPER RINGOLD UNIT
MIDDLE RINGOLD UNIT
LOWER RINGOLD UNIT
BASAL RINGOLD UNIT
Ringold Formation
ELEPHANT MOUNTAIN MEMBER
RATTLESNAKE RIDGE INTERBED*
POMONA MEMBER
SELAH INTERBED*
ESQUATZEL MEMBER
COLD CREEK INTERBED*
SILLUSI FLOW
UMATILLA FLOW
UMATILLA MEMBER
MABTON INTERBED*
Saddle Mountains Basalt
LOLO FLOW
ROSALIA FLOW
PRIEST RAPIDS MEMBER
ROZA MEMBER
SENTINEL GAP FLOW
SAND HOLLOW FLOWS
SILVER FALLS FLOW
GINKGO FLOWS
PALOUSE FALLS FLOW
FRENCHMAN SPRINGS MEMBER
Wanapum Basalt
VANTAGE INTERBED*
UNNAMED FLOWS
ROCKY COULEE FLOW
COHASSETT FLOW
UNNAMED FLOWS
McCOY CANYON FLOW
SENTINEL BLUFFS SEQUENCE
UMTANUM FLOW
VERY HIGH Mg FLOW
AT LEAST 30 FLOWS TO BASE OF GRANDE RONDE BASALT
SCHWANA SEQUENCE
Grande Ronde Basalt

*INTERBEDS ARE STRATIGRAPHICALLY CONTAINED IN THE ELLENSBURG FORMATION

RCP8207-4X

Attachment B

LOCATION MAP


Vantage
WASHINGTON
PASCO BASIN
HANFORD SITE
PASCO BASIN
YAKIMA R.
COLUMBIA R.
REFERENCE REPOSITORY LOCATION
COLD CREEK SYNCLINE
SNAKE R.
Richland
N
0
10
20 MILES
WALLA WALLA R.
PS8604-1

Attachment C

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

NUCLEAR WASTE BOARD - NUCLEAR WASTE ADVISORY COUNCIL

- PROGRAM PARTICIPANT SINCE 1983
- $10,341,000 CUMULATIVE FUNDS AUTHORIZED TO DATE

SCOPE OF INVOLVEMENT

POLICY REVIEW

- MISSION PLAN
- SITING GUIDELINES
- COMMINGLING STUDY
- SITE CHARACTERIZATION PLAN
- CONSULTATION AND COOPERATION
- LEGAL ANALYSIS
- SOCIOECONOMIC PLANNING AND DATA GATHERING
- ENVIRONMENTAL PLANNING AND DATA GATHERING

TECHNICAL REVIEW

- HYDROLOGY
- GEOLOGY
- TECTONICS
- TRANSPORTATION

PUBLIC INVOLVEMENT

- MEDIA
- NEWSLETTER
- READING ROOM & SERVICE CENTER
- FACT SHEETS
- SLIDE SHOWS
- PUBLIC WORKSHOPS
- PUBLIC HEARINGS
- CITIZEN SURVEYS

STATE OF WASHINGTON LEGISLATURE

- PROGRAM PARTICIPANT SINCE 1984
- $1,518,000 CUMULATIVE FUNDS AUTHORIZED TO DATE

SCOPE OF INVOLVEMENT

LEGISLATIVE INFORMATION

- NEWSLETTER
- WORKSHOPS
- CONFERENCES
- LEGISLATIVE ACTION FILE
- TOURS

SUPPORT TO RADWASTE SUB-COMMITTEES AND LEGISLATIVE MEMBERS OF NUCLEAR WASTE BOARD

- REPORTS AND BRIEFINGS
- RESEARCH

STATE OF OREGON
OREGON DEPARTMENT OF ENERGY

- PROGRAM PARTICIPANT SINCE 1985 (THRU STATE OF WASHINGTON)
- $500,000 PER YEAR FOR 5 YEARS (STARTING IN FY 1987)

SCOPE OF INVOLVEMENT

POLICY REVIEW

- SITE CHARACTERIZATION
- SITE CHARACTERIZATION ENGINEERING STUDY PLANS
- MISSION PLAN

TECHNICAL REVIEW

- HYDROLOGY
- GEOLOGY
- TECTONICS
- ENVIRONMENTAL
- TRANSPORTATION

PUBLIC INVOLVEMENT

- MEDIA
- PUBLIC WORKSHOPS
- PUBLIC INFORMATION
- SPEAKERS BUREAU

YAKIMA INDIAN NATION NUCLEAR WASTE PROGRAM

- PROGRAM PARTICIPANT SINCE 1983
- $5,766,000 CUMULATIVE FUNDS AUTHORIZED TO DATE

SCOPE OF INVOLVEMENT

POLICY REVIEW

- MISSION PLAN
- SITING GUIDELINES
- COMMINGLING STUDY
- CONSULTATION AND COOPERATION
- LEGAL ANALYSIS
- TOURS

TECHNICAL REVIEW

- HYDROLOGY
- GEOLOGY
- HYDROCHEMISTRY
- GEOCHEMICAL

PUBLIC INVOLVEMENT

- NEWSLETTER
- WORKSHOPS
- LIBRARY
- MEDIA
- HEARINGS

CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION NUCLEAR PROGRAMS OFFICE

- PROGRAM PARTICIPANT SINCE 1984
- $2,817,000 CUMULATIVE FUNDS AUTHORIZED TO DATE

SCOPE OF INVOLVEMENT

POLICY REVIEW

- MISSION PLAN
- SITING GUIDELINES
- DRAFT ENVIRONMENTAL ASSESSMENT
- SITE CHARACTERIZATION PLAN
- CONSULTATION & COOPERATION AGREEMENT
- LEGAL ANALYSIS

TECHNICAL REVIEW

- GEOLOGY
- HYDROLOGY
- RISK ASSESSMENT
- TRANSPORTATION

TRIBAL ACTIVITIES

- LIBRARY
- WORKSHOPS
- NEWSLETTER
- MEDIA
- HEARINGS
- SOCIOECONOMIC PLANS AND DATA
- ENVIRONMENTAL PLANS AND DATA

NEZ PERCE INDIAN NATION
NEZ PERCE NUCLEAR WASTE POLICY ACT

- PROGRAM PARTICIPANT SINCE FY 1985
- $2,876,000 CUMULATIVE FUNDS AUTHORIZED TO DATE

SCOPE OF INVOLVEMENT

POLICY REVIEW

- MISSION PLAN
- SITING GUIDELINES
- DRAFT ENVIRONMENTAL ASSESSMENT
- SITE CHARACTERIZATION PLAN
- CONSULTATION & COOPERATION AGREEMENT
- LEGAL ANALYSIS

TECHNICAL REVIEW

- REGIONAL IMPACT STUDIES
- TRANSPORTATION
- EMERGENCY RESPONSE

TRIBAL ACTIVITIES

- LIBRARY
- NEWSLETTER
- MEDIA
- HEARINGS
- WORKSHOPS
- SOCIOECONOMIC PLANS AND DATA
- ENVIRONMENTAL PLANS AND DATA

The CHAIRMAN. First of all, you say that the State of Washington is working toward having an on-site representative at the Hanford site, and you also point out that you have, since 1983, granted $23.8 million in grants to affected parties.

Why is it that the State of Washington does not have that on-site representative?

Mr. ANTTONEN. I think first the State of Washington probably made a decision not to have an on-site rep until after the site was recommended as one of the sites for characterization, which happened approximately a year ago. I know the State has been in the process of trying to locate an on-site rep. In fact, last Friday in my monthly meeting with the State project manager, he indicated that they are going to have an on-site rep selected shortly.

The CHAIRMAN. The State of Washington has been invited over a period of time to have someone present as an on-site rep to watch every stage of these proceedings. If they haven't, at least it is not the fault of DOE?

Mr. ANTTONEN. That is correct. We have encouraged the State of Washington and the other participants to have on-site reps.

The CHAIRMAN. You have also had a series of hearings, have you not, to keep the public informed of this process as it proceeds?

Mr. ANTTONEN. Yes. We had the series of hearings when we issued the environmental assessment. Also we had quite an active public information program, education program, where we had tours of the Hanford site. We have an active speakers bureau that goes out and explains the program to different audiences through the Northwest.

The CHAIRMAN. We have heard general criticism of the Nuclear Waste Program to the extent that local states and communities have been excluded from the process, that DOE has been high-handed and secretive. I don't know what all the descriptions have been. Part of the charge that the program is in disarray is that you have not allowed for local input. Would you comment on that charge, whether it is correct or not, and if not, what you have done to cooperate?

Mr. ANTTONEN. I think the activities that I have identified in my statement, show that we have been going out and encouraging participation by the States, the Indian tribes, and the NRC, and also keeping the local community advised of the status of the program.

The CHAIRMAN. Has the local community or the state been deprived of any information or barred from any meeting or any discussion that they have requested?

Mr. ANTTONEN. I am not aware of any meeting, or any information that the local community has not been given if they have requested it.

The CHAIRMAN. Is there any substance at all to a charge, if made by anyone, that you have not fully and completely cooperated to the fullest extent?

Mr. ANTTONEN. We have been cooperating to the fullest extent possible. We have limited resources also, and so with the limited resources we have, we have been cooperating with the participants.

The CHAIRMAN. Mr. Anttonen, one of the biggest criticisms of the Hanford site—well, the first one is that it costs so much. Is that true, and why does it cost more than the other sites?

Mr. ANTTONEN. If you are referring to the construction of the repository, yes, it does cost more. The reason for that is in comparison to the other geologic media, basalt is a harder rock. Therefore, it takes you more time to go through the mining operation, and, therefore, it costs you more money.

The CHAIRMAN. How much more do you figure it will cost? We have heard the figure $4.5 billion more than the other sites.

Mr. ANTTONEN. We are in a process right now of trying to get our arms around the actual cost, a better handle of the repository. Also, we are in the process right now of trying to put together our cost of our site characterization activity. We are costing out our site characterization plan. I will be happy to supply that information to you at a later date when we get that information.

[The information follows:]

Based upon a conceptual estimate, corresponding to the BWIP conceptual design, the repository construction costs very between $1 billion and $2 billion higher for BWIP. BWIP is estimated at $3.45 billion, Salt at $2.30 billion and Tuff at $1.22 billion. The total life cycle cost estimates are BWIP at $11.38 billion, Salt at $9.33 billion, and Tuff at $6.46 billion

The CHAIRMAN. Well, that order of magnitude, did that seem to make sense, the $4.5 billion?

Mr. ANTTONEN. I believe that was the approximate number that was included in the environmental assessments.

The CHAIRMAN. How about the cost of characterization? Can you give us any ballpark figures?

Mr. ANTTONEN. I may want to refer to Steve, but I think ours is pretty close to the other two projects, approximately a billion dollars for characterizing the site.

The CHAIRMAN. A little more or a little less?

Mr. ANTTONEN. Probably a little more. Like I mentioned, we are in the process of pricing out our site characterization plan right now. As a project, we are going to give that information to Mr. Kale at the end of August. That is our time frame. Like I mentioned, the site characterization plan is really the first baseline of the project. It is going to tell you where we are and how we are going to go through the site characterization.

The CHAIRMAN. Can you tell us in general what you do in a characterization plan?

Mr. ANTTONEN. The characterization phase?

The CHAIRMAN. In characterization, what do you do? Do you drill a shaft. A shaft of what size, series of shafts, wells, what all do you do?

Mr. ANTTONEN. We will have a series of activities, including both surface activities and underground activity. We will be doing surface activities to gather both geologic and hydrologic information. We will be doing surface activities to gather seismic information. We will be doing both surface and underground facilities to gather rock mechanics information. We will constructing an exploratory shaft.

The CHAIRMAN. Can you tell us—You dig a shaft. How big? What do you do underground?

Mr. ANTTONEN. The exploratory shaft, at least our design is that we would construct two shafts, one would be six feet in diameter finished. The other would be 10 feet in diameter finished. You would connect those and you drill those shafts. You drill them down to roughly 3,200 feet, which is the cohassett flow, and then you would connect those two at about 3,200 feet of tunneling. You would do underground testing——

The CHAIRMAN. Thirty-two hundred feet of tunnel?

Mr. ANTTONEN. Yes, between the two shafts. You do underground testing in the tunnel. The total program is roughly—to design and construct a facility is roughly about $250 million. Also, we will be conducting designs, advanced conceptual designs during the site characterization phase of the waste package, and also of the repository.

That is quickly a summary of the types of activities that we would be doing during site characterization.

The CHAIRMAN. One final question because we have other witness, and I would like to question you for a long time because you have so much information, but since we have the other witnesses I want to cut it short. Tell me about the Columbia River. The charge made is that the rock body at the Hanford site is full of water, and that it will allow radionuclides to travel quickly to the Columbia River. Is this an accurate characterization?

Mr. ANTTONEN. Yes. The Columbia River runs adjacent to the Hanford site.

The CHAIRMAN. How close?

Mr. ANTTONEN. The closest point would be north approximately 6 to 10 miles from the repository location. Hydrology at Hanford is the key issue in my opinion. Like I mentioned earlier, we do have some information on the hydrology. But we have to get a lot more information on the hydrology at Hanford, and that is going to be one of the key parts of our site characterization program, and that is to determine both the direction of flow and the rate of flow from the potential site of the repository to the acceptable environment.

When I mentioned the location of the river in proximity of the potential repository, that was due north from where the repository would be located. To date, with the information that we have, the path of flow is projected in the southeasterly direction. From the preliminary indications, the point of egress to the access of the environment is off site in a southeasterly direction approximately 75 miles. Again, that is preliminary information.

The CHAIRMAN. What is the rate of flow?

Mr. ANTTONEN. I do not have that number off the top of my head. I will have to get that. It is very slow and our projection would be to reach the accessible environment is about 80,000 years. There have been projections from people using the same data that say that it could be from two years to a million years.

[The information follows:]

Pre-waste emplacement ground water travel time has been estimated, based on current data, and is presented in the Environmental Assessment, Reference Repository Location, Hanford Site Washington (EA). These estimates are based on preliminary information and significant additional data will be required to reach a firm conclusion. These discussions are found in Section 6.4.2.6.1 on pages 6–307 to 6–319. Mean estimates of travel times presented in the EA range between 22,000 and 940,000 years and median travel times ranged between 22,000 and 73,000 years. These estimates do not take into account flow through the Cohassett dense interior, which would increase travel times. These estimates are for travel time to the "accessible environment" five kilometers from the edge of the repository. The Columbia

River is outside the accessible environement boundary for which travel time has been estimated.

Mr. **ANTTONEN**. In my opinion, that is the purpose of site characterization; to look at the issue, get the information and be in a better position come years from now to make a determination of——

The **CHAIRMAN**. Do you have high confidence that the characterization can give you the data that you need?

Mr. **ANTTONEN**. Yes. We have high confidence. Like I mentioned, we are working with the participance, and we have general agreement on our pre-exploratory shaft testing program. I say general agreement with the participants. I am talking about the Nuclear Regulatory Commission, and the State of Washington, and the affected Indian tribes in the State of Oregon.

The **CHAIRMAN**. I said a moment ago that was going to be the last question, but this one really is. I am going to ask this same question to the others. If we should go to a one site characterization mode, in other words, pick our best site of the three and put all our resources on that, do you have a view as to what degree of confidence that the site picked could measure up? I know it is a speculation and a guess. What are the odds that one of the sites you would pick would be suitable in your view?

Mr. **ANTTONEN**. That is a very difficult question to answer because I think the three sites are different. They are different geologic media, and it would be awfully difficult to answer. I can't answer it.

The **CHAIRMAN**. Senator Hecht.

Senator **HECHT**. No questions.

The **CHAIRMAN**. Senator Evans.

Senator **EVANS**. If I understand correctly, at least two of the major problems, and maybe the two major problems at Hanford, perhaps at all of the sites for that matter but let me speak directly to Hanford because that is your responsibility, would be the questions of faulting and of hydrology?

Mr. **ANTTONEN**. I identify the three major problems as hydrology, the in situ stress, and then major seismic activity, the fault.

Senator **EVANS**. At the national level in the Department of Energy they appear to be determined to move ahead as rapidly as possible on major bore hole activity. You described the 6 and the 10 inch diameter bore holes. Do you believe that it is wise to do that before further drilling has been done on a smaller basis to map the hydrology and understand the hydrology better?

Mr. **ANTTONEN**. On our project what we are doing is we are going to get hydrology data prior to proceeding with the sinking of the exploratory shaft. Also, what we will be doing is gathering data on other parts of the program that are—to resolve the critical technical issues such as the seismology question, the waste package question, the nature resource potential question. Our program is a balanced program.

Senator **EVANS**. On page 8 of your testimony you say, "Construction of the exploratory shaft facility is the next major activity following finalization of the SCP, but before that work can proceed we must complete some major hydrologic testing to obtain data on conditions that would be disturbed by construction of the exploratory shaft facility."

How long is that likely to take? Can you describe the nature of that work which you feel must be done before you get to any major bore hole activity?

Mr. ANTTONEN. The pre-ES hydrology program, the way we have it laid out right now is roughly a 22 month program.

Senator EVANS. Twenty-two months from now or from when it is started?

Mr. ANTTONEN. From now. We are looking at—at least our schedule is to complete that activity in June of 1989. That includes establishing the first part of the program would be the hydrologic baseline by conducting some large scale pump test where you pump a hole and then monitor the impact around the site. After the baseline is established, then we would conduct some testing at the flow top which is above the cohassett flow. We would conduct some testing in the center of the cohassett flow and also in the flow top below the cohassett flow.

So that is the pre-ES hydrology program that would take approximately a 22 month period of time.

Senator EVANS. You would suggest that during that 22 month period of time no large shaft activity be conducted?

Mr. ANTTONEN. After we got agreement on the pre-exploratory shaft hydrology program, and identified what impact that would have on the overall schedule, we made a decision to take a look at the option, whether we could drill through the upper sediments and do that prior to completing the 22 month hydrology program.

We are in the process right now of kicking off that evaluation. The reason why we looked at it is there may be a potential that we could save a significant amount of time on the overall schedule. If there is no impact on the technical aspects of the program, then it may be to our advantage to proceed with sinking the shaft prior, just through the upper sediments, prior to the June or 1989 time frame.

Senator EVANS. It was clear back last fall, the Department of Energy nationally was pushing ahead very strongly for a larger appropriation than we ultimately gave then, and the necessity for that larger appropriation was to proceed immediately with those large bore holes. What has changed? Or have we got a different opinion from the local level than the national?

Mr. ANTTONEN. I believe we have the same opinion, both the headquarters and my project. I guess it is really a matter of timing. When we were putting together our 1988 budget, we were just at the same time trying to get closure on our pre-ES hydrology program. We finally got closure on that aspect of the program in April of this year.

Senator EVANS. But I am not talking about the 1988 budget. I am talking about the 1987 budget. So prior to the budget for the year which is now almost over there were assertions in front if this committee and others that they were ready to drill the bore holes, and the only thing that had kept them from doing it was the fact that the appropriation was cut back to the extent they could not, and were denied the opportunity by the provisos put in the appropriation act.

You are telling me now that the hydrology assessment was not completed until April of this year?

Mr. Anttonen. That is when we completed the hydrology assessment. Also one thing that has delayed the program or project approximately a year is that we have been under a stop work order. The purpose of that stop work order was to get our management approach in place, getting our quality assurance and our business management system in place.

So that has delayed all our activities. We have not initiated any new work over the last year.

Senator Evans. You certainly have a lot of money appropriated to do work. Nothing has been done?

Mr. Anttonen. Not all activity was stopped. The preparation of the site characterization plan, which is our major activity, just getting the documentation training in place for the stop work order was completed. We also continued to gather information from existing bore holes. So there was activity. Out of the 1,300 work packages or activity on the project, about half was stopped as a result of the stop work order.

Senator Evans. The stop work order was on the basis of lack of appropriation, or on the basis that you wanted to take another look and get things in order and get—what did you call it?—the discipline?

Mr. Anttonen. The purpose of the stop work order is that we are entering into a separate new phase of the project which is into a licensing phase, the site characterization. So we just wanted to make sure that we had the discipline management approach in place as we entered into site characterization. We did not have it a year ago.

Senator Evans. The stop work order was done for purposes that had nothing to do with appropriations?

Mr. Anttonen. That is correct. I would have to go back and take a look a little bit at the history. I cannot remember the statements that were made by people in headquarters and the project office on the appropriations, but I will be happy to respond for the record.

[The information follows:]

The reason for the Stop Work Order issued to Rockwell by DOE on May 1, 1986, quoting from this letter, is "to insure that appropriate management and technical prerequisites (e.g., QA procedures, and training, etc.) are in place." At no place in this letter or in subsequent correspondence is the reason for the Stop Work Order in any way tied to project appropriations either directly or indirectly.

Senator Evans. It would be helpful to respond in writing. The material you have just given us is really quite useful. I guess it is interesting, Mr. Chairman, because it doesn't seem to parallel some of the statements we had from the national headquarters people as to what they intended to do and the requirement for the money that they thought they needed during the fiscal year we are now in, and for that matter the fiscal year which we are going to deal with, fiscal year 1988.

Are you aware of horizontal movement in certain levels of the hydrology in that area that could or have carried materials to the Columbia in as little as 30 years?

Mr. Anttonen. Are you talking about hydrologic movement?

Senator Evans. Yes.

Mr. ANTTONEN. Yes. We have been investigating the site since 1976. We have a total of approximately—I cannot remember the exact number—but approximately 50 deep bore holes that we have drilled on the site to date. We have approximately 100 or so shallow bore holes that we have been monitoring since the mid-1970s to gain information, hydrology information, on the site. Yes, we do have that information.

Senator EVANS. Does that information show that at certain levels water can move horizontally approximately that fast, 30 years, to the Columbia River?

Mr. ANTTONEN. The rate of flow is what we have to resolve in the direction during site characterization. I think what you are referring to is the rate of flow in the unconfined aquifers, which are in the upper levels of the sediment. The rate of flow there is pretty quick to the river. The rate of flow on the confined aquifers are adept by the ones we are interested in to determine what is the rate and what is the direction of flow. Is it going directly horizontal direction, or does it go into a vertical direction? Does it go into a step type of direction? That is the information that we need to determine whether we have an acceptable site. We will be looking at that during site characterization.

Senator EVANS. Would you say that vertical flow, or if you found vertical flow from those deep aquifers, that that would be a disqualification of that site? Vertical flows that would carry it up to the unconfined aquifers?

Mr. ANTTONEN. If we have a communication between the unconfined and the confined aquifers, we could not meet the criteria. So, yes, we would have to step back and determine what is causing that.

Senator EVANS. In terms of acting in a cost effective manner, would it make sense as I think it is commonly done in a good many other types of projects to investigate first, spend money first on those things which may be most likely to disqualify a site, or which are the cheapest and easiest to determine as to whether they might disqualify a site?

Mr. ANTTONEN. I believe we have a program in place that addresses all the critical issues. One of the programs I mentioned was the hydrology, the pre-ES hydrology program. So we do have a program in place to do that up front. We also have a program in place to talk about the seismicity of the area. I believe we do have a program in place to address those issues up front.

Senator EVANS. Let me turn to the seismic issue. What are you planning to do on the seismic issues, and what would be the potential problems that might disqualify a site in terms of its seismicity?

Mr. ANTTONEN. What we are doing right now is putting together as part of our site characterization plan our program covering seismicity. We also, by the way, are working with the State of Washington, with their participation, of looking at some of the recent information that they have surfaced on the seismicity issue.

Hopefully when we get the site characterization plan out and reviewed, we can get closure on the technical program of what is required to address the seismicity during site characterization.

Senator EVANS. What do you have to do in the seismicity program to get the information you need?

Mr. ANTTONEN. What we are going to have to do is determine whether we have any faulting in the area, and what is the extent of the faulting in the area to create a pathway to an accessible environment, the deep geologic formation.

Senator EVANS. How do you determine that? Is it primarily through additional bore holes or what is the technology for making that determination?

Mr. ANTTONEN. It is a combination of things. Some you use a flyover, and I forgot what the right technical term is. Others you can use by running a line across the site and determining by impact and the response if there is any folding or faulting underground. So they are the two techniques that we are looking at. Then you monitor the impact in bore holes, new bore holes, or existing bore holes on the site.

Senator EVANS. Let me veer from that on a question that relates to seismicity but necessarily to deep geologic storage. Assuming that the casks which would be utilized to hold the waste material are essentially the same, as I understand it, as the casks that would be used during any intermediate storage in an MRS, the major difference being one is placed deep underground. The other is placed at or close to the surface. If there were seismic activity, for whatever reason, no matter how careful we are, if there was seismic activity at a deep underground storage facility with the fault line shifting close to where these casks were stored, would that have a larger potential impact on the integrity of those casks in deep storage than it would if they were on the surface?

Mr. ANTTONEN. I really am not technically qualified to answer that question. I would like to respond officially to the record to that question if you don't mind, or maybe ask one of my colleagues to respond to it.

[The information follows:]

The answer depends on the proximity of the casks to zone of deformation resulting from the fault. If the casks were located underground but beyond the zone of deformation, the effect of ground motion on equipment and structures deep underground is generally less than equipment and structures located at the same distance from the epicenter on the surface. If the casks were located deep underground but within the deformation zone of the fault, damage would probably be greater than if the casks were located at the same point on surface.

Senator EVANS. At least it seems logical that when something is held underground in a firm place and a sheering action occurs on it, that it is much more likely to be badly damaged than if it is on the ground and just gets toppled around. There are no forces really acting on it above ground, other than to knock it over.

How long does that DOE plan to give the states to review the site characterization plans?

Mr. ANTTONEN. The document will be issued in final form to the states, NRC, and the Indian tribes this fall At the present time what I am doing is that as we get chapters and sections of that plan completed, I am giving copies to both the states, Indian tribes, and also the NRC.

My schedule right now is to get all the draft chapters to the participants in August, with the issuance of the document in final in the October-November time frame, and then the participants have three months to review that particular document.

Senator EVANS. How long?

Mr. ANTTONEN. Three months after final issuance.

Senator EVANS. About how long is the document, or do you anticipate it will be?

Mr. ANTTONEN. The document is approximately—the document itself, the site characterization plan, is roughly about five to six thousand pages in length. If you add on to that the study plans, then you are looking at a sizeable document, a total document of 10,000 pages or so. So it is a big document.

Senator EVANS. Do you think 90 days is sufficient to examine a 10,000 page document?

Mr. ANTTONEN. I think with the draft chapters that are given to the participants, and like I mentioned, they will be given to them in August, that should be adequate time for them to review it.

Senator EVANS. Thank you, Mr. Chairman.

The CHAIRMAN. Mr. Vieth.

STATEMENT OF DONALD L. VIETH, PROJECT MANAGER, WASTE MANAGEMENT PROJECT OFFICE, NEVADA OPERATIONS OFFICE, DEPARTMENT OF ENERGY

Mr. VIETH. Thank you very much, Mr. Chairman and Members of the Committee. My name is Donald Vieth, and I am director of the office that is managing the investigation of the mountains of the Yucca Mountain site in Nevada. I am pleased to have this opportunity to discuss these activities. I will present a brief history of the site, a description of the site's specific technical issues, a current status of activities, and a summary of our interactions with the representative State and local governments.

Let me turn now for a short history. In 1976, DOE's predecessor, The Energy Research and Development Administration, initiated the National Waste Terminal Storage Program to develop geologic repositories. In April of 1977, ERDA expanded the NWTS program to focus on a wider variety of geologic formations, including those at the Nevada Test Site.

By August of 1978, DOE focused its effort on six potential sites in the southwest corner of the NTS, including Skull Mountain, Calico Hills, Jackass Flats, Little Skull Mountain, Wahmonie Mountain, and Yucca Mountain. Yucca Mountain was judged to have the best overall prospects for being considered a suitable repository site.

For the next three and one-half years, the NNWSI project performed a series of technical activities that resulted in data which provided the basis for the identification of Yucca Mountain as a potentially acceptable site for the first repository under the Nuclear Waste Policy Act of 1982.

Now let me turn to the site specific technical issues and how they are being addressed. The requirements for determining the suitability of a site are outlined in the DOE siting guidelines, 10 CFR Part 960, the NRC regulations, 10 CFR Part 60, and the EPA standard, 40 CFR Part 191.

Data developed in response to these requirements during the initial site investigations have established a fundamental understanding of the site and identified site specific technical issues.

While all issues revealed in the development of a site's description must be successfully addressed, some are more challenging to unravel or have a larger effect on isolation. The six major issues important to the Yucca Mountain site include the following: One, the definition of the saturated zone hydrologic regime. The level of the water table over an area of 400 square miles has been established; there questions on the long term stability of the water table. In addition, the lateral direction and magnitude of the ground water flow must be defined to facilitate the evaluation of the site against the EPA standard.

To resolve these issues a large number of water wells have been drilled and continually monitored to define the level of the water table. Correlations of the fluctuation of the water table with other physical events will provide an understanding necessary to estimate the long-term stability of the water table. Measurements of the hydrologic properties of the formation will provide additional information required to confirm estimates of the amount of water that will move through the formation.

The second issue is the potential for hydrothermal activity. Deposits of minerals of calcite and silica found at the site indicate substantial quantities of water have been present in the past. The major question is the time of their occurrence and the source of the water.

To resolve this issue the U.S. Geological Survey has selected a team of scientists and developed a detailed study plan to evaluate the formation. Last month a special peer review panel of independent experts went to the site to see the formations and to review the proposed study plan of the U.S. Geological Survey. Although the written comments of the panel have not been received, their verbal comments were strongly supportive of the technical approach.

The third area is the definition of the unsaturated zone hydrologic regime, that is the area above the water table. The primary questions to be resolved are: How much of the water that falls on the surface percolates down to the water table? By what mechanism does it get there? How much water is actually moving through the rock? And how chemically reactive is the water?

To resolve these questions a two-pronged attack is underway. The first is based upon measurements of the hydrologic potential as a function of depth, with numerous bore holes drilled without the use of water. The second will be the measurement of the hydrologic characteristics of the formation in the exploratory shaft. Eleven different experiments have been developed to measure the hydrologic characteristics of the unsaturated zone in the exploratory shaft facility.

The fourth area is the definition of the ground motion that could effect an operating repository. Before designing the surface facilities we must know the range of magnitudes and the nature of the ground motion that could result from fault movement. To resolve this issue it is essential to evaluate the 32 known faults in the 425 square miles that surround Yucca Mountain. The U.S. Geologic Survey will continue its program of surface mapping, geochemical sampling and geophysical techniques to establish the magnitude and time of previous movements.

In addition, the USGS will continue to operate a seismic network in the region of Yucca Mountain which was initiated in 1979.

The fifth area is the evaluation of the effects of earthquakes or fault movements on the isolation after the repository is sealed. After repository is closed, however, the direct effects of earthquakes and fault movement on waste isolation is expected to be minimal. A potential concern of the project is the possibility that fault movements, or other tectonic activities might change the current hydrologic conditions of the site.

To resolve these issues geologic, hydrologic, geochemical, and geophysical data will be collected by the USGS and Los Alamos National Laboratory to determine the location of potential fault activities, the time and frequency of their past movements and to develop a description and numerical, techtonic, and hydrologic model of the Yucca Mountain site.

The sixth and final area is the evaluation of the potential future volcanic activities at the site. The possibility that future volcanic activities at Yucca Mountain site is suggested by the geologic history of Southern Nevada. To address these concerns, the USGS and Los Alamos National Laboratory have been conducting extensive field work, drilling and sampling isotopic age dating, geochemical analysis to determine the origin of the basaltic cinder cones, and their eruption frequency in order to calculate probabilities of future volcanic activities that might affect waste isolation.

The data collected thus far indicated volcanic activity in the region occurs infrequently and poses no significant hazard. Now let me turn to the status of site activities.

The CHAIRMAN. Let me interrupt you at that point, Mr. Vieth, because we do want to allow plenty of time for questioning, and I think we have read your statement.

[The prepared statement of Mr. Vieth follows:]

STATEMENT OF

DONALD L. VIETH, PROJECT MANAGER
WASTE MANAGEMENT PROJECT OFFICE
NEVADA OPERATIONS OFFICE
DEPARTMENT OF ENERGY

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

JUNE 29, 1987

Mr. Chairman and Members of the Subcommittee:

My name is Don Vieth and I am Project Manager for the U. S. Department of Energy's (DOE) Waste Management Program Office In Las Vegas, Nevada. I am pleased to have this opportunity to discuss the Nevada Nuclear Waste Storage Investigation (NNWSI) Project that is evaluating the Yucca Mountain Nevada site, relative to development of the first high-level radioactive waste repository in the U.S. I plan to present a brief history of activities conducted at the site from May 1977 to May 1987; a description of technical issues specific to the Yucca Mountain Site and the way in which they are being addressed; the current status of the investigations at Yucca Mountain; and a summary of our interactions with representatives of the State and local governments in Nevada.

History of the Site

Let me begin, however, by identifying the Yucca Mountain site. The site is located nearly 100 miles northwest of Las Vegas in Nye County, Nevada, on and adjacent to the southwest portion of the Nevada Test Site (NTS). The site is on three adjacent parcels of Federal land, each under the separate control of DOE, the U.S. Air Force and the Bureau of Land Management, respectively. Attachment A shows the relative location of the site in the State of Nevada, and Attachment B depicts the Yucca Mountain site relative to the NTS.

Now to focus on the history to establish the site; in 1976, DOE's predecessor, the Energy Research and Development Administration (ERDA), initiated the National Waste Terminal

Storage (NWTS) Program to manage the permanent disposal of high-level radioactive waste in geologic repositories. In April 1977, ERDA proposed "prior land use" as a site screening criterion. Concurrently the U.S. Geological Survey (USGS) proposed that the Nevada Test Site (NTS) be considered for evaluation due to the multiplicity of natural geological barriers. In April 1977, ERDA expanded the NWTS program to focus on a wider variety of geologic formations in addition to those at the NTS.

As the NNWSI Project began a preliminary examination of the area, DOE established a task force to evaluate the conditions wherein the Nuclear Weapons Test Program could exist in reasonable proximity to a repository. In August 1978, DOE determined that a repository located in the 245-square-mile area in the southwest corner of the NTS would not likely create any operational conflicts in the conduct of the weapons test program, and likewise, the testing program would not adversely affect the operation of a repository. Thus did NNWSI begin to assess six potential sites: Skull Mountain, Calico Hills, Jackass Flats, Little Skull Mountain, Wahmonie Mountain, and Yucca Mountain.

In the late summer of 1978, an exploratory drill hole at Yucca Mountain confirmed the presence of layers of thick, highly sorptive tuff media. Because tuff had not been considered as a host rock for a repository, a presentation was made to the National Academy of Science (NAS) Committee for Radioactive Waste Management. After considering the potential advantages and disadvantages of this rock, the Committee supported the DOE proposal and supported the consideration of volcanic tuff and the Yucca Mountain site. Preliminary exploration at the NTS continued until April 1979, when the DOE concurred with a USGS recommendation that the NNWSI Project focus on Yucca Mountain. Yucca Mountain was judged to have the best overall prospects for being considered a suitable repository site.

For the next three and one-half years, the NNWSI Project performed a series of analyses, peer reviews and technical assessments intended to confirm the focusing of activities based on limited data for the Yucca Mountain site, and identify the specific host rock at the site. The confirmation process resulted in (1) the identification and prioritization of 40 site-specific objectives based on existing DOE and Nuclear Regulatory Commission (NRC) criteria, and (2) the assessment of 31 physical attributes which vary throughout the NTS area and might have a potential impact on a repository. Finally, a study of eight comparison factors of four different rock units at Yucca Mountain resulted in the selection of the Topopah Spring Member of the Paintbrush Tuff as the specific formation for investigation to be a potential site for a repository.

This series of technical activities, which took place between April 1977 and February 1983, resulted in the development of data that provided the basis for identification of Yucca Mountain as a potentially acceptable site for the first repository under the Nuclear Waste Policy Act of 1982.

Site Specific Technical Issues and How They Will Be Addressed

The requirements for determining the suitability of a site are outlined in 10 CFR Part 960, 10 CFR Part 60 and 40 CFR Part

191. Based on these regulations, the Department has created a hierarchical structure of issues to evaluate in a systematic manner the site and demonstration of its capabilities for isolating waste for 10,000 years.

Data developed during the initial site investigations have established a fundamental understanding of the site. The Environmental Assessment, along with the Multiattribute Utility Analysis of Sites Nominated for the First Radioactive Waste Repository, presented this preliminary data in the context of the requirements to make a decision. Comments received on these documents did not identify any new areas of concern of which the Department was not already cognizant. If the comments had a common denominator, it was the statement that not enough is known about the sites to establish a final conclusion. This means that more measurements, analyses and interpretations are required before all issues are resolved and a final decision is made. This is the purpose of site characterization.

While all issues revealed in the development of the site's description must be successfully addressed, some are more challenging to unravel or are known to have a larger effect on isolation. For the Yucca Mountain site, the issues that are of specific concern fall into three major categories: groundwater characteristics, seismic-tectonic characteristics, and potential for human intrusion. Each of these characteristics can be subdivided into groups of technical issues in the following manner:

- Groundwater Characteristics
  - Definition of the saturated zone (below the water table) hydrologic regime.
  - Potential for hydrothermal activity
  - Definition of the unsaturated zone (above the water table) hydrologic regime.
- Seismic/Tectonic Characteristics
  - Definition of the ground motions that could affect an operating repository.
  - Evaluation of the effects of earthquakes and fault movements on waste isolation after the repository is sealed.
  - Evaluation of potential for future volcanic activity at the site.
- Potential for human intrusion
  - Existence of natural resources at Yucca Mountain

The following is a short summary of these technical issues, many of which have been raised by the States and/or Indian Tribes, and the efforts underway at Yucca Mountain to resolve them.

1. Definition of the Saturated Zone Hydrologic Regime - The level of the water table over an area of 400 square miles has been established. The direction of movement of water, up or down, has been evaluated at several locations. The purpose of this effort is to establish the direction and the rate at which hydrologic conditions may change. We need to estimate the long-term stability of the water table; that is, the potential for it

to rise or fall depending on a change in climate or as a result of a change in the tectonic forces. It is essential to evaluate this to determine whether it is possible for the water table to rise 500 to 800 feet to inundate the repository. In addition, the lateral direction and magnitude of the groundwater flow must be defined to facilitate the evaluation of the site against the EPA standard (40 CFR Part 191).

To resolve these issues, a large number of water wells have been drilled to continually monitor the level of the water table. Correlation of the fluctuation of the water table with other physical events will provide the understanding necessary to make estimates of the long-term stability of water table. Measurements of the hydrologic properties of the formation will provide additional information required to confirm estimates of the amount of water that will move through the formation. Use of tracers in large pump tests will help confirm the estimates of groundwater travel time on the flowpath from the repository to the accessible environment.

2. Potential of Hydrothermal Activity - Deposits of the minerals calcite and silica found at the site are indicators that substantial quantities of water have been present at this location in the past. The major question is the source of the water: Are the mineral deposits the result of precipitation from surface waters evaporating slowly or are they the results of precipitation of minerals from waters from a hydrothermal source deep within the earth? In addition, the time in the past when the formations were created is important for judging whether the phenomena will occur again.

To resolve this issue, the USGS has selected a team of scientists and developed a detailed study plan covering broad interdisciplinary capability to evaluate this formation. Last month, a special peer review panel of independent experts went to the site to see the formations and reviewed the proposed study plan of the USGS. Although the written comments of the panel have not been received, their verbal comments were strongly supportive of the technical approach. We specifically want to note that the State's technical experts were invited and attended the peer review and have been given full access to all the activities and information on this issue.

3. Definition of the Unsaturated Zone Hydrologic Regime - The horizon for the proposed repository was selected in the unsaturated zone because of the absence of standing water. However, this does not mean that the formation is free of water slowly moving through it. While such formations appear dry to the human eye, they contain about a gallon of water per cubic foot of rock. The primary questions to be resolved are: How much of the water that falls on the surface percolates down to the water table; how fast does it move; by what mechanism does it get there; how much water is actively moving through the rock; and how chemically reactive is the water?

To resolve these questions, a two-pronged attack is underway. The first is based on measurements of the hydrologic potential, as a function of depth, in numerous boreholes drilled without the use of water. The second will be measurements of the hydrologic characteristics of the formation from the exploratory shaft.

Eleven different experiments have been developed to measure the hydrologic characteristics of the unsaturated zone in the exploratory shaft facility. I would emphasize that we recently met with the NRC and the State of Nevada to consult with them on the change in configuration of the exploratory shaft. The driving force behind the change is to expand the experimental program to more thoroughly address the technical issues raised by the State and the NRC. The results of the meeting indicate both the NRC and the State supported the changes we proposed. By these changes, we believe that we have been responsive to issues raised by the State and NRC.

4. Definition of the Ground Motion That Could Affect an Operating Repository - Numerous faults exist in the vicinity of Yucca Mountain. Movement along these faults could produce ground motion that would be experienced by the surface facilities as well as the subsurface facilities. The ground motion is far more significant for surface facilities than for subsurface facilities. Before designing the surface facilities, we must know the magnitude and nature of the potential ground motion.

To resolve this issue, it is essential to evaluate the 32 known faults in the 425 square miles that surround the Yucca Mountain site which showed movement in the Quaternary Period (the last 1.8 million years). The USGS will continue its program of surface mapping, geochemical sampling, and geophysical techniques to establish magnitude and time of previous movements. In addition, the USGS will continue to operate the seismic network in the region of Yucca Mountain which was initiated in 1979. We are currently investigating the need to improve the capability of the network to quantitatively define the magnitude of the ground motion and more accurately pinpoint the location of earthquake epicenters and determine the mechanism causing them. We further plan to involve the State and the NRC in the discussion of the proposed changes in this network and offer the State research team a satellite link so that they will have real time access to data measured in the field.

5. Evaluation of the Effects of Earthquakes and Fault Movements on Waste Isolation After the Repository Is Sealed - The 32 known faults in the 425 square mile area surrounding Yucca Mountain that have shown movement in the Quaternary Period has supported speculation that they could also affect the site's ability to isolate the waste. Some of the faults may be capable of moving tens of centimeters in a single event. Since these events have an average recurrence time measured in tens of thousands of years, there is a likelihood that earthquakes and fault movements will occur within the 10,000 year period after the repository is sealed. After the repository is closed, however, the direct effect of earthquakes and fault movements on waste isolation is expected to be minimal. This is principally because little groundwater is expected to be available to dissolve and move the waste even if a waste canister is damaged. Of more concern is the possibility that fault movements or other tectonic activity might change the current hydrologic conditions of the site. Such changes could conceivably cause the water table to rise, or increase the rate of groundwater movement to the water table.

To resolve these issues, geologic, hydrologic, geochemical and geophysical data will be collected by USGS and Los Alamos National Laboratory to determine the locations of potentially active faults, the time and frequency of their past movements, and to develop descriptive and numerical tectonic and hydrologic models of the Yucca Mountain site. Extensive field and subsurface investigations will be conducted to ensure that the waste storage areas of the repository do not intersect potentially active faults. A committee of independent experts in tectonics and seismology has been assembled and has been working with the Project for more than a year to define these potential problems and to recommend a research program to resolve the issues.

6. Evaluation of Potential for Future Volcanic Activity at the Site- The possibility of future volcanic activity at the Yucca Mountain site is suggested by the past geologic history of southern Nevada: volcanic rocks are abundant in the area. In fact, Yucca Mountain, including the strata of the proposed repository, is made up of rocks formed from volcanic activity that occurred 12 million years ago. In addition, more recent basaltic volcanic activity, occurring during the past two million years, has produced several small basaltic cinder cones in the vicinity of Yucca Mountain. The major concerns regarding the potential for renewed volcanism include the possibility of direct disruption of the repository by volcanic activity, and the possible effects of future volcanism on the hydrologic conditions at the site.

To address these concerns, the USGS and Los Alamos National Laboratory have been conducting extensive field work, drilling and sampling, isotopic age dating and geochemical analyses to determine the origins of the basaltic cinder cones and their eruption frequencies in order to calculate the probabilities of future volcanic activity that might affect waste isolation. The data collected thus far indicate that volcanic activity in the region occurs infrequently and poses no significant hazard. In fact, estimates of annual probability for a local volcanic eruption, based on this preliminary data, range from one chance in a million to one in 10 million per year. Future investigations are planned to increase our understanding of regional volcanic processes and to further refine these preliminary results, especially in the determination of the time and frequency of eruption of the youngest volcanic deposits.

7. Existence of Natural Resources at Yucca Mountain - It is important to evaluate the potential for natural resources, such as minerals and hydrocarbons, at the Yucca Mountain site because of the possibility they could stimulate future human intrusion into the repository during exploration and exploitation. In addition to determining if resources exist at the site, it is equally important to determine if the geology of the site might be conducive to future exploration, regardless of the actual presence of resources. Future exploration activities, such as exploratory drilling, could disrupt the repository enough to cause release of radionuclides if they were to occur in the 10,000 years after the repository is closed.

To resolve this issue, a systematic evaluation for mineral and energy resources will be conducted during site characterization. Detailed chemical analyses of rock samples from holes drilled and from the surface will be performed for specific metallic and "indicator" elements; geophysical studies will be conducted to assess the potential for future exploration; and grade and tonnage will be calculated for specific commodities to ascertain the potential for their exploitation. The hydrocarbon potential of the older (that is, Paleozoic) sedimentary rocks which occur deep beneath Yucca Mountain will be evaluated from their surface exposures elsewhere and from calculations of heat-induced changes, based on the depth of the sediments and the geologic history of the area. The State is conducting an independent study of the mineral resources in the vicinity of Yucca Mountain which the NNWSI Project and the Nevada Operations Office is supporting and facilitating.

Status of Site Activities

The site characterization phase officially began on May 28, 1986, with Presidential approval of the Yucca Mountain site. Since that time, the major effort of the NNWSI Project has been the development of a Site Characterization Plan (SCP), which provides three things: (1) an extensive document describing the current state of knowledge of the site; (2) identification of, and DOE's strategy for, resolving technical and regulatory issues; and (3) the technical activities to be conducted to characterize the site. DOE's current plans are to release the SCP later this year to NRC, the State of Nevada, and the public for review and comment. This will be the culmination of many years of intensive effort to understand and address the issues surrounding the selection of this site as one of the candidates for the nation's first high-level nuclear waste repository. More than 100 Study Plans augmenting the SCP must be prepared to provide the NRC and the State with specific details about the testing program prior to initiating field activities.

Many investigations which began prior to Presidential approval of the site for site characterization, have continued uninterrupted into the site characterization phase. Hydrologic, seismic and meteorologic monitoring programs are in place.

Stop-work orders initially imposed by the NNWSI Project's own Quality Assurance (QA) organization have been almost completely rescinded. The stop-work orders were issued by management to assure that the scientists and engineers supporting the technical program properly document their work to guarantee its maximum credibility in the licensing forum. Project participants were required to prepare QA Level Assignments and supporting Scientific Investigation Plans for each of their activities and submit them for DOE approval.

Although the stop-work orders have been largely rescinded, most scientific field activities will continue to be held in abeyance pending completion and issuance of the Site Characterization Plan and the preparation, review and approval of more than 60 study plans. We expect the step-by-step resumption of all activities within the year after the SCP is released and study plans are formally approved.

State and Local Interactions

In addressing this point, I would like to divide the discussion into two segments: (1) interactions dealing with governmental organizations of the State and local communities; and (2) interactions with citizens.

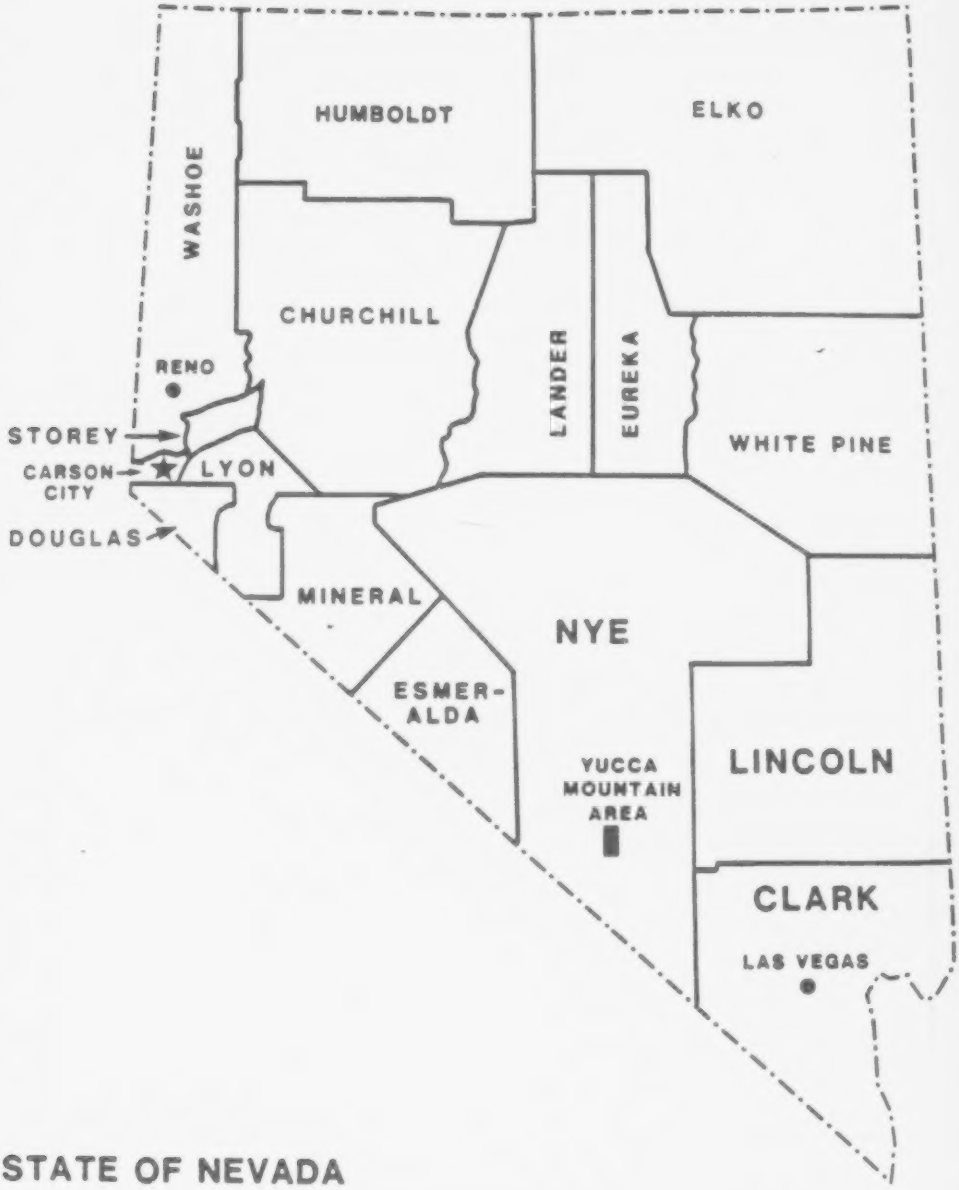
The intention of the NNWSI Project is to work in a cooperative and positive manner with the State to facilitate their oversight responsibility that was assigned by the Congress. Proposals by DOE to initiate Consultation and Cooperation Agreement negotiations extended to the State have been continuously rejected. The State has indicated that full funding of its grant request is one prerequisite for initiation of C&C Agreement negotiations. Despite the views expressed by the State regarding our handling of its grant, we believe we have made a very strong effort to effectively represent the State's grant request through the Federal budget cycle. Since 1983, we have provided more than $15.3 million to the State in response to its grant requests. This amounts to 80 percent of the amounts requested by the State. The Project Office has approved the grant requests in a professional manner and has not denied any grant requests for properly fundable activities. It is interesting to note that for 1987, the State's grant request was $10.14 million; the Governor's request to the State legislature for grant spending authority for funds received under the grant was only $8.4 million; and the Legislature finally approved $8.3 million. With our recent review of the supplemented grant request, the state will receive a minimum of $8.4 million this year.

Since 1984 we have worked cooperatively with the state in numerous and effective forums. We have invited them to the monthly two-day NNWSI Project management meeting; offered office space in the field near Yucca Mountain for state scientists; established a protocol for State contractor access to the Nevada Test Site; arranged for the State's contractors to tour the Yucca Mountain site; provided state counsel with access to Project files for purpose of discovery; participated with the state's informal working group in numerous meetings and workshops; participated as observers in the peer review of the state's socioeconomic studies; responded to the State's request for access to the NNWSI Project's computerized media-reference system for newspaper and magazine clippings; provided comments to the State on its draft public information factsheets and periodic newsletters; periodically participated in county commission meetings for Clark, Nye and Lincoln counties; testified before the State's legislative Committee on High-Level Radioactive Waste and the state's Commission on Nuclear Projects; provided background information and facts to the legislative committee on request; and organized an extensive tour of the WIPP site for Nye County officials and Nevada Commission on Nuclear Projects.

Similarly, our interactions with the general public have been of a wide ranging and positive nature. We have worked with citizens from the three counties and eight communities near Yucca Mountain. We have an active speaker's bureau that provides presentations to local service organizations. The Nevada Operations Office holds town meetings on a monthly basis throughout the State and the repository program is a prominent subject of the meeting. We have given the news media full access to information about the program. We have responded to media requests to appear on public service programs and newscasts. By far our most effective interaction is the tour program we conduct at the Nevada Test Site. Here we can present a complete view of the Yucca Mountain site as well as tours of such facilities as Climax and G-tunnel which are analogous to a repository. Between 1983 and the present, more than 12,000 persons have taken this tour. These visitors have been quite responsive.

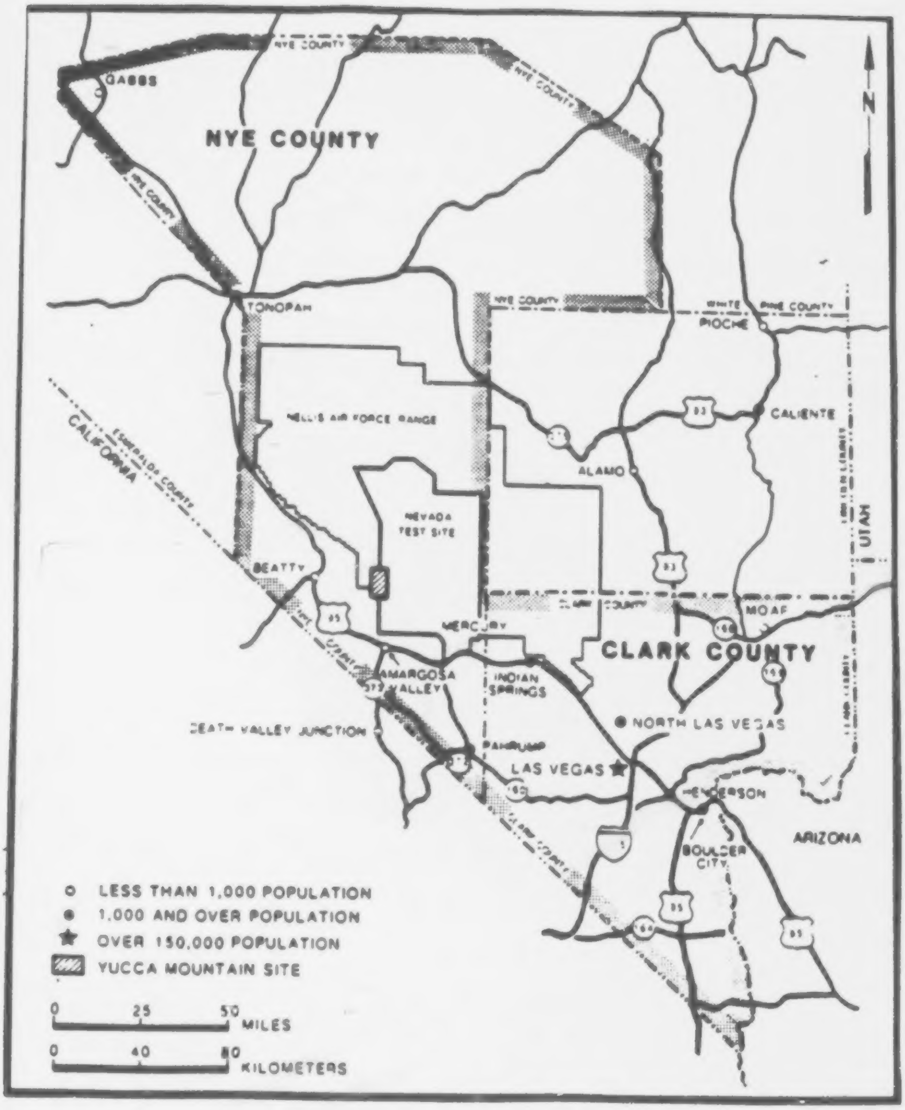
With that last comment, I would like to close my testimony, express the hope that I have adequately addressed the points of interests and offer to answer any question that may remain about our efforts at Yucca Mountain. Mr. Chairman, I would be happy to answer any questions you or other members of the Committee may have now or after my colleagues present their testimony.

Attachment A


HUMBOLDT
ELKO
WASHOE
CHURCHILL
LANDER
EUREKA
RENO
STOREY
CARSON CITY
LYON
DOUGLAS
WHITE PINE
MINERAL
NYE
ESMER-ALDA
YUCCA MOUNTAIN AREA
LINCOLN
CLARK
LAS VEGAS

STATE OF NEVADA

Attachment B


NYE COUNTY
GABBS
NYE COUNTY
TONOPAH
NELLIS AIR FORCE RANGE
NEVADA TEST SITE
ESMERALDA COUNTY
CALIFORNIA
BEATTY
95
MERCURY
AMARGOSA VALLEY
373
INDIAN SPRINGS
DEATH VALLEY JUNCTION
PAHRUMP
160
LAS VEGAS
NORTH LAS VEGAS
HENDERSON
BOULDER CITY
CLARK COUNTY
MOAPA
168
PIOCHE
CALIENTE
93
ALAMO
WHITE PINE COUNTY
LINCOLN COUNTY
UTAH
ARIZONA
15
164
95
N
○ LESS THAN 1,000 POPULATION
● 1,000 AND OVER POPULATION
★ OVER 150,000 POPULATION
▨ YUCCA MOUNTAIN SITE
0 25 50 MILES
0 40 80 KILOMETERS

The CHAIRMAN. On page 14 and 15 of your statement you go into some detail about the fact that proposals by DOE to initiate consultation and cooperation agreement negotiations to the state have been continuously rejected.

Mr. VIETH. Yes, sir.

The CHAIRMAN. First of all, tell us what you mean by consultation and cooperative agreements and how those have been rejected.

Mr. VIETH. We have offered a number of times, in letters between myself and the project manager for the State, and between the Secretary and the Governor to enter into these discussions or negotiations to consummate a C&C agreement.

Our view of a C&C agreement is that it is a vehicle that lays out the formal and informal interactions by which the project office that I am responsible for and the State will interact in the conduct of activities and to involve them in the process of understanding what it is we are doing, soliciting their views, giving us the opportunity to respond to them.

The CHAIRMAN. I understand they say that before they do that you have to fund their grant request?

Mr. VIETH. They ask for 100 percent funding of their grant request before they——

The CHAIRMAN. Otherwise, they will not enter into it?

Mr. VIETH. That is right.

The CHAIRMAN. And they ask for $10.14 million?

Mr. VIETH. Yes, sir.

The CHAIRMAN. And you funded $8.3 million, and yet the Governors request to the legislature for authority to spend that money was only for $8.4 million.

Mr. VIETH. Can I clarify a point there?

The CHAIRMAN. Yes.

Mr. VIETH. They requested $10.14 million from us. In our reviews of the grant, we have given them a total of $7.9 million, and with the latest review we will add another $400,000 to that, bringing it up to about $8.4 million.

Now, in the request that the Governor made to the State Legislature in January, he only requested spending authority from the State Legislature for the money that is provided by the Department of $8.4 million, and the legislature which just closed about a week and a half ago, has approved $8.3 million of the $8.4 million requested by the Governor.

The CHAIRMAN. Does that mean in effect you have fully funded the Governor's request to the legislature?

Mr. VIETH. I think we have provided an amount of money equal to what the Governor asked of the legislature, but have not completely funded what they have asked of us.

The CHAIRMAN. Have you funded enough? Were any of their requests denied that should not have been denied in your judgment?

Mr. VIETH. Within the context within which we are operating, and guidelines laid down by the 9th Circuit Court of Appeals, we feel that we have honored fully the request of the State.

The CHAIRMAN. Mr. Vieth, as you know, this is a very controversial area, and we are told that DOE will not cooperate, they will not fund requests, they will not make available things. Comment generally on that. Is that charge correct, or is it not?

Mr. VIETH. Personally I do not believe that is a correct evaluation of the situation. I think that right now there is only one issue between my office and that of Bob Lux and that is over the grant. If you look at how we are continuing to operate on a day-to-day basis, I think we have a very good working relationship at our level.

There are strong indications of that cooperation. For example, we have been invited to the peer reviews of the state of their socioeconomic peer review. They sit in my 2-day monthly management meeting.

So the kinds of things that go on at a working level I think are fairly good. I think the only area of concern we have is the evaluation of their grant request.

The CHAIRMAN. What are the issues in the grant?

Mr. VIETH. I think the only issue that we have left to resolve is the technical justification, that is scientific justification of the work they are doing. I left at home my props that I was going to show you, which would demonstrate for a given study area the Department and my project must produce a document that may be between 100 to 200 pages long explaining our technical studies. It lays out the scientific and technical details of how we will execute the study.

The State submitted a request that consists of two to three pages for a similar kind of activity, say on the calcite silica studies. In reviewing their submissions, as a technical person, it was difficult to read into the proposal the substance, the scientific activities that are going to go on, and only for this reason have we rejected them. We are down to those last few items that need to be sorted out.

The CHAIRMAN. In other words, there was some request for funding of matters which really lacked scientific substance?

Mr. VIETH. I do not know whether or not the intent lacked scientific substance, but the explanation does. And we are prepared to sit down with the people and we have made the offer to sit down at a table and try to work this out, but that has not been picked up. We will make that offer again when I sign the letter out when I get back from this trip.

The CHAIRMAN. Can you guarantee this committee and the Congress and the American people that you will fully and fairly and openly be cooperative with the State of Nevada in this whole siting activity so that we will not wake up some morning and read about some secret deal concocted in the back room where Nevada officials were excluded from? Can you guarantee us that?

Mr. VIETH. For those activities that I am responsible for I can guarantee you that.

The CHAIRMAN. Can you guarantee us that that has been the history in the past of this matter?

Mr. VIETH. For the project in Nevada I believe it is an accurate statement of the situation.

The CHAIRMAN. Mr. Vieth, we have heard a lot of criticism of the Nevada site. They say we just simply should not use the Nevada site, first of all. That it is subject to ground water flows, that with the nuclear test site close by that that is inconsistent with the location of the repository there, that it is subject to techtonic forces, seismic forces which disqualify the site.

The response we have heard from others here is that those criticisms can only be resolved in a definitive manner by characterization. My question to you is do you know of any reason why this site is unsuitable at this point? Is there any better way to find out the suitability than by characterization?

Mr. VIETH. At the present time I have no information that would lead me to believe that this site would not be suitable for a repository. There are numerous questions that still have to be answered, questions for which more technical detail will be required in order to convince a licensing panel that the site is suitable and should be licensed.

That process can only be completed through the site characterization process that lays before us. I see no other way of getting the information that is necessary.

The CHAIRMAN. Mr. Vieth, as I asked Mr. Anttonen earlier, with respect to your site, let us say that we suspended activity on the other sites and proceeded to characterize one site at a time. There are advantages to doing that, of course. You save a couple of billion dollars. Secondly, I think it was both the NRC and the—or at least the National Academy of Sciences said one advantage is you can focus your scientific talent on one site.

Now the disadvantage is that in case the first site, wherever it is, turns out to be unsuitable, then you must go to the next one and there would be a time delay. It has also been criticized in that there might be some pressure because of the time delay to get it done.

Now, can you elucidate a little bit about the degree of confidence you would have that the site would be suitable? Is there any way in the world to tell? Do you think it is more likely that it would be suitable than non-suitable? Is three sites enough to characterize it, or should we have ten sites? Can you speak to that?

Mr. VIETH. Let me try to put it in proper perspective. We have looked at the site fairly thoroughly since 1977. I think we understand the nature of the forces that are acting on the site. If one takes the information we have now, and tries to project the kinds of things that are liable to be discovered in the next five or six years of site characterization, it is not conceivable to me that we would discover something of a major nature that would cause us to change our mind about it.

I think that we are comfortable in our analysis that the site would be capable of meeting the NRC requirements and EPA requirements. The processes of doing the modeling and the calculations that estimate the radioactive releases from the repository tells us that we may be five orders of magnitude below a very conservative EPA standard.

I think that we are very confident about the potential for that piece of earth being able to isolate the waste if it is placed there.

Now with regard to your question about the philosophy about how you go about picking and choosing sites, I think there are a number of other forces that we have to deal with. This issue goes back to as early as 1978 when the NRC was initially writing its regulations. They argued that in order to satisfy NEPA appropriately, you had to consider at least three sites in at least in two different geologic media.

So that philosophy has held for almost ten years now, and if we are going to deviate from that, then we are going to have to go back and look at some other broader factors like NEPA and so on, which we are still required to fulfill under the Nuclear Waste Policy Act.

The CHAIRMAN. NEPA would not suspend, or would not override what we would do. The question is, would it be prudent to do because, as I say, you save $2 billion, which is not insignificant even in the United States. The question is is it prudent. In your view you would have a high degree of confidence with respect to your site, the Nevada site, that you could prove its ability to isolate the waste?

Mr. VIETH. I have a fairly high level of confidence about the site for which I am responsible. Whether or not it is prudent as national policy, I do not know whether or not I am the person to that question.

The CHAIRMAN. Will you tell me about the Ghost Dance Fault at Yucca Mountain? Is it a limiting fault?

Mr. VIETH. The Ghost Dance Fault is a geologic feature that runs on the eastern side of the specific block that we are looking at for the repository. It is not a limiting fault from the point of view of affecting the amount of radioactive waste to be placed in the site. It is simply a geologic feature. We know where it is. We know most of its characteristics. We do not see it as a problem from a safety or operational point of view in the repository.

There are other faults that bound the site such as Solitier Canyon Fault, or the fault under Drill Hole Wash, or the Imbricate Normal faults to the east which do represent a limit. While they represent a boundary for the block of the repository, Ghost Dance Fault does not.

The CHAIRMAN. There are other faults that would act as a limit?

Mr. VIETH. Yes, there are.

The CHAIRMAN. And the limit in the law now I think is 70,000 tons, at least in the plan. In your view, would those faults which do limit the site, would they permit 70,000 tons or more? Do you have a view on that?

Mr. VIETH. With the land that we have now in the conceptual design of the repository that has been completed, we are looking at an area of roughly 1,850 acres. The 70,000 metric tons calculated at 57 kilowatts per acre in terms of heat load would fill an area of roughly 1,520 acres. We may have about 300 acres of additional space for disposal of waste in excess of 70,000 metric tons.

If we looked at some other positive ways of doing things, we can estimate that up to 100,000 metric tons of waste could be placed in the 1,850 acres of land.

The CHAIRMAN. The 1,850 acres, is that the limit as you know it now?

Mr. VIETH. Yes, but there is potential to expanding to the area to the north, however we will not know that until we get underground and look at the perceived fault that lays underneath of Drill Hole Wash.

The CHAIRMAN. What age would the waste be on which you make the calculation of how much—how many tons per acre?

Mr. VIETH. The age that we are making the calculation on is based upon 10 years out of reactor.

The CHAIRMAN. If you kept it out for longer than 10 years, then I take it would be able to more closely stack your waste?

Mr. VIETH. The evaluation that has been done indicates that a great deal of the waste that is already available to us now as spent fuel has been out of the reactor for far more than 10 years, into 30 or 40 years time frame.

So we would expect the age of the waste that is going to a repository will be out of the reactor longer than 10 years.

The CHAIRMAN. Could you not, because of the lesser waste heat, stack it closer together and, therefore, accommodate more than 70,000 or 100,000 tons?

Mr. VIETH. That is in fact true, yes.

The CHAIRMAN. Have you done the calculations on how much you could store at given ages?

Mr. VIETH. I think that there have been some calculations done in, as I remember, back in 1981. Those are the last ones I have seen and calculation has been made based upon fuel out of the reactor 50 years and 100 years. I think they were specifically in response to the request of the report that you asked for in the hearings in 1981. I think that we can see a change in capacity by a factor of one and a half or two as I indicated in the report.

The CHAIRMAN. Mr. Vieth, I have some more questions, but I will submit questions to you and to the other witnesses in writing, and the other Senators may have written questions as well.

Senator Hecht.

Senator HECHT. Thank you. Mr. Chairman, you asked a lot of questions that I was going to ask, so I can go on. Following through on what you mentioned about 1,860 acres, you know, we looked at all the nuclear waste France has accumulated from the 1950s to the present day, and here it was in a room about the size of this room right here stacked up. If we reprocessed the civilian waste like the military waste, what would that do to this repository?

Mr. VIETH. In terms of reducing the amount of acreage that would be required?

Senator HECHT. Yes.

Mr. VIETH. Frankly, we have not really looked at that question mainly because of the position of disposing of or considering disposing of spent fuel since around the turn of the decade. I would assume, though, you would be able to see a reduction in area, but I would not expect that it would be extensive.

Senator HECHT. A reduction in area and probably a reduction in money spent to characterize. Is that correct or not?

Mr. VIETH. I think that the amount of effort that you have to spend to characterize the site is going to be the same regardless of whether the waste form is spent fuel or processed high level waste.

Senator HECHT. How are you going to handle one area of civilian waste and another area of military waste, and am I correct in assuming that both are going to be put in there, is that correct?

Mr. VIETH. I believe both the spent fuel and the waste from the military program will be put in the same facility.

Senator HECHT. How are you going to handle this? What are your plans?

Mr. VIETH. In the repository at Yucca Mountain one of the things that we do have to be concerned about is the heat load, and we are trying to take advantage of the fact that we can use the heat to the positive benefit for ourselves by driving off moisture from the waste package, and thereby minimize the potential for corrosion or degrading of the waste package.

One consideration is to find a way to mix the spent fuel and the defense waste in the same holes because you are looking for the benefit of the heat from the commercial fuel to give you a level of protection for the waste package for defense waste. It is obvious that defense waste is less intense in terms of the heat output.

Another thought is to focus the waste from the commercial site in the center and put the waste from the defense program around the perimeter of the repository. So there are different strategies of placing the waste depending on what you want to achieve.

Senator HECHT. I will not ask you for your opinion because you are with the Department of Energy and I understand that, but you understand that France, which I still go back to as having a complete nuclear policy, a complete cycle. They feel it just is not smart to dispose of nuclear waste that has not been reprocessed.

Mr. VIETH. Spent fuel going into the ground is certainly a difficult question. It still has a tremendous resource of energy in terms of the plutonium that could be used for operation of reactors. Having also been myself to France, I share a certain degree of sympathy for their logic. At the present time it is not clear that there is going to be development of reprocessing in this country for a number of different reasons.

Senator HECHT. We understand that, but now before we start spending any money, before we go actually into the final act of disposing of waste, now is the time to look into this.

After you have the repository, and this was brought up by the French scientist, if you want to bring waste back up again, would there be any type of allowances in the repository that you could bring this fuel up again?

Mr. VIETH. Certainly with the requirements that were established by the Nuclear Regulatory Commission you can require it to be able to retrieve the waste for a period up to 50 years after you place it.

Senator HECHT. For how long was that?

Mr. VIETH. Fifty years.

Senator HECHT. I was under the impression it was 100. I am glad I asked.

Mr. VIETH. You have to look at the design of the repository to satisfy retrievability requirements which result in the 100 year design basis. It takes 50 years to put it in and 50 years to get it out. You have to make sure that it will last for the 100 years time frame.

There is a difficulty with that. There is the fact that one of the requirements that we have to satisfy is to have a waste package that we can demonstrate will last 300 to 1,000 years. It is going to be fairly expensive strategy to put the spent fuel into that kind of package only for the purposes of temporary storage if the intent is to get them back. It seems that there are a lot of other ways to keep the spent fuel on the surface for the purposes of storage without having to commit to a huge cost associated with the high quality waste package required for placing spent fuel in the repository.

Senator HECHT. How deep were you planning on going for the repository?

Mr. VIETH. At the Yucca Mountain site we are looking at a repository, where the exploratory shaft is, it is about 1,000 feet below the surface. Yucca Mountain is not a flat surface, and so you cannot say that one number is the average depth, but about 1,000 feet.

Senator HECHT. Which would make it very, very difficult to bring it back up again.

Mr. VIETH. Not exactly difficult, but troublesome.

Senator HECHT. How do you feel about the legislation I introduced about a cooling off period the same way France does? I put 50 years into the bill. They talk 42, 44, whatever. Do you feel that would make it easier for you to handle the waste?

Mr. VIETH. There are two sides of that question. Reducing the amount of heat that is generated is generally something that is considered a positive feature. In the repository at Yucca Mountain, since we were going to have that heat, we tried to find a way to make it work to our advantage. By having the heat there we can control the temperature in the repository over a long period of time, and thereby keep the water away from the waste package and minimize the potential for degrading. The less heat that is available to us, the shorter the period of time in which the positive physical effects will be available to us.

In a repository that may be in salt, the temperature should be kept at a minimum, in our particular case we are looking for just the opposite effect, and the bill that you propose may give us a little bit more technical problems than if we had the waste right out of the reactor.

Senator HECHT. This is a question that you might not want to answer again, but I am going to throw it out at you. Are you positively convinced that this is the right approach to a nuclear repository, because other countries tend to be exact are looking at the sub-sea bed disposal?

Mr. VIETH. I think that the geologic repository is the only technology that I know of that can be implemented today for disposal of waste. While sea bed has some very positive features about it, I think the institutional problems associated with that are going to be far more difficult to deal with than they might be if there is only a single government. When you have 70 or 80 countries to agree on the sea bed, it may be a little bit more difficult to achieve consensus in the solution.

Senator HECHT. Other countries are looking into it. It will have to be addressed at some time.

Mr. VIETH. Yes, I understand. They are looking into it, but I think they all face the same institutional problem.

Senator HECHT. We will see how they come out on it and we will know better. You mentioned 32 known faults. Would you mind providing my office with those faults, because I am very, very much in favor of continuing nuclear testing. I think we have to continue nuclear testing. We have to go into SDI and so forth, and what these

32 known faults, I would just like to have a picture of it. Would you give me that information?

Mr. VIETH. We will be very happy to provide you a map with all the faults on them and properly identified.

[The information follows:]

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PRELIMINARY REPORT ON LATE CENOZOIC FAULTING AND STRATIGRAPHY IN THE VICINITY OF YUCCA MOUNTAIN, NYE COUNTY, NEVADA

By

W C Swadley, D. L. Hoover, and J. N. Rosholt

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ABSTRACT

Mapping of surficial deposits and examination of faults in natural and trenched exposures in a 1100 km^2 area around the site of a potential repository for radioactive waste at Yucca Mountain have identified 32 faults that offset or fracture Quaternary deposits. Where the amount of Quaternary offset can be estimated, dip-slip movement is on the order of 3 m or less on faults in and near Yucca Mountain. Maximum Quaternary offset within the study area may be as much as 30 m. No strike-slip movement was demonstrated nor can it be ruled out.

Based on radiometric ages, correlations of stratigraphic units, and field observations, Quaternary faults are divided into three broad age groups: five faults moved between about 270,000 and 40,000 years ago; four faults moved about 1 m.y. ago; and 23 faults moved probably between 2 m.y. and more than 1.2 m.y. ago. Offset of Holocene deposits has not been demonstrated.

INTRODUCTION

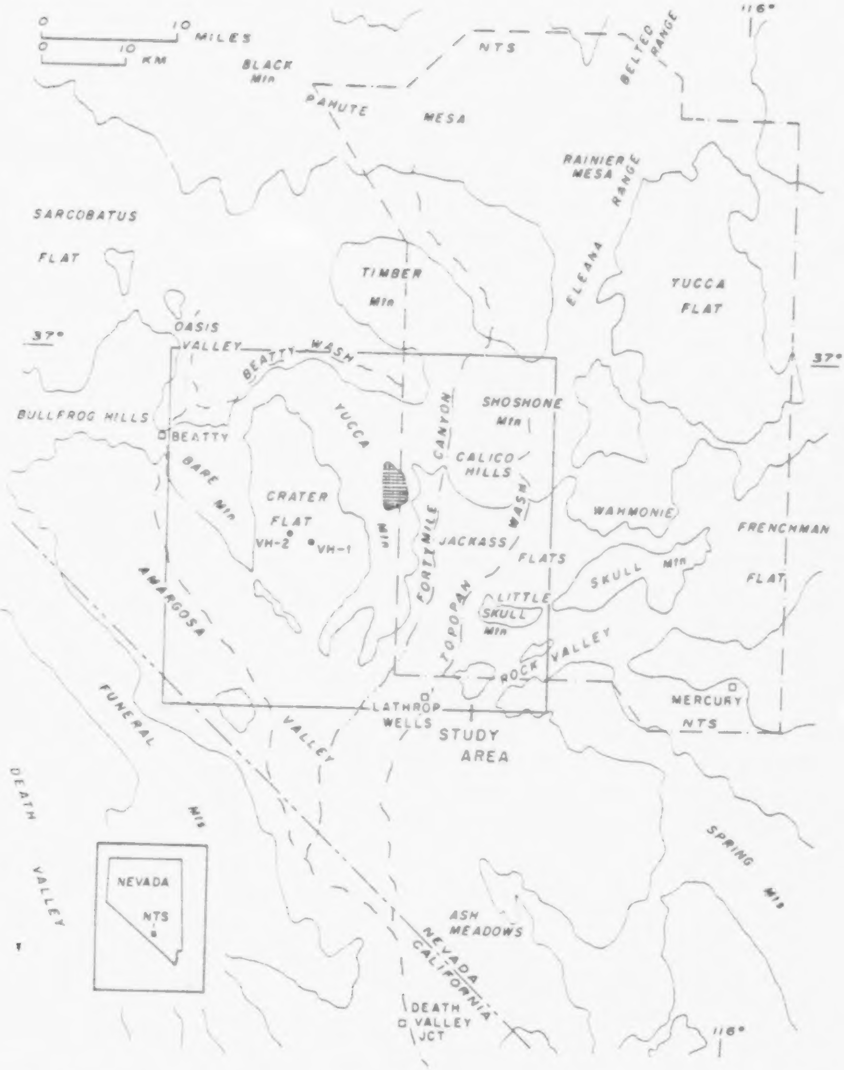
Geological and hydrological investigations to evaluate Yucca Mountain in southern Nye County, Nevada (fig. 1), as the possible site for an underground radioactive waste repository were begun by the U.S. Geological Survey in 1978. These studies are being conducted in cooperation with the U.S. Department of Energy Nevada Nuclear Waste Storage Investigations. This report summarizes a reconnaissance study of late Cenozoic faulting in the vicinity of Yucca Mountain. Detailed investigations of faults in the Yucca Mountain area are continuing, but data and preliminary conclusions are presented at this time for use by the U.S. Department of Energy and others involved in evaluating the Yucca Mountain site.

The purposes of this fault study were to determine the location and extent of faults in the Yucca Mountain area that displace late Pliocene and Quaternary deposits and to make a preliminary assessment of the amount and age of fault displacements on which to base more detailed investigations.

This report is based on published and unpublished surficial maps of the Yucca Mountain area by Swadley and Hoover. Uranium-trend isotopic dates were determined by Rosholt. Preliminary analysis of trenches excavated across faults in the study area were by Swadley and Hoover unless noted otherwise.

GEOLOGIC SETTING

Yucca Mountain is in the southern Great Basin, an area chiefly characterized by north-trending linear mountain ranges that are flanked by extensive alluvial fans and separated by broad alluvial basins. Most ranges are deeply incised by narrow stream valleys. The climate is arid and vegetation is limited to sparse desert plants.


0
10 MILES
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BLACK Mtn
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MESA
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SARCOBATUS
FLAT
TIMBER Mtn
YUCCA
FLAT
OASIS
VALLEY
37°
BEATTY WASH
37°
BULLFROG HILLS
BEATTY
BARE Mtn
CRATER
FLAT
VH-2
VH-1
YUCCA Mtn
CANYON
FORTYMILE
SHOSHONE Mtn
CALICO HILLS
WASH
JACKASS
FLATS
WAHMONIE
FRENCHMAN
FLAT
SKULL Mtn
LITTLE
SKULL
Mtn
TOPOPAH
ROCK VALLEY
AMARGOSA
VALLEY
FUNERAL
Mts
LATHROP
WELLS
STUDY
AREA
MERCURY
NTS
DEATH
VALLEY
SPRING
Mts
NEVADA
NTS
ASH
MEADOWS
NEVADA
CALIFORNIA
DEATH
VALLEY
JCT
116°

Figure 1.--Map of Nevada Test Site area showing location of Yucca Mountain and site of potential waste repository (shaded area).

The exposed bedrock in the vicinity of Yucca Mountain consists of Precambrian and Paleozoic quartzite, shale, and carbonate rocks and Tertiary volcanic rocks (fig. 2) (Stewart and Carlson, 1978). These rocks locally are overlain by late Tertiary and Quaternary surficial deposits. The area lies within a major Miocene volcanic field and contains several calderas, which produced voluminous pyroclastic deposits including the tuffs that underlie Yucca Mountain (Byers and others, 1976). Small basalt lava flows and cinder cones erupted in the Crater Flat area during the late Pliocene and Pleistocene.

Yucca Mountain consists of a series of subparallel ridges that are formed by blocks of resistant Tertiary volcanic rocks, mainly densely welded tuffs, which dip gently eastward and are bounded by north-trending faults. The areas bordering Yucca Mountain and the valleys between the ridges making up Yucca Mountain are underlain by alluvial gravels and, locally, by eolian deposits. The bedrock geology of Yucca Mountain is shown on maps by Christiansen and Lipman (1965), Lipman and McKay (1965), and Scott and Bonk (1984). The geology of the Bare Mountain quadrangle, west of Yucca Mountain, was mapped and described by Cornwall and Kleinhampl (1961). The volcano-tectonic history of Crater Flat (fig. 1) is discussed by Carr (1982).

METHODS

Late Cenozoic surficial deposits in the vicinity of Yucca Mountain were mapped on the basis of stratigraphy described by Hoover and others (1981). Mapping in the field was supplemented by the interpretation of conventional aerial photography. The locations of faults that offset the surficial deposits are shown on plate 1 along with the areal distribution of generalized time-stratigraphic surficial units.

Twenty-three trenches (pl. 1) were excavated in the Yucca Mountain area to evaluate Quaternary fault movement. Fourteen trenches are on Yucca Mountain or in valleys that border it; six trenches are on adjacent ridges that parallel Yucca Mountain; and the remaining three trenches are in the eastern part of Crater Flat, southwest of Yucca Mountain. Some trenches were excavated across recognized fault scarps, and others were placed in surficial deposits across the projection of a known bedrock fault.

Trenches were excavated using bulldozers to depths of 2 to 4 m and lengths of 20 to 40 m. The trenches were mapped by establishing a level line and a 2-m reference grid from which readily recognized stratigraphic units, sedimentary features, soil horizons, faults, and fractures were plotted. (The term fracture, as used in this report, refers to planar breaks in the deposits along which there is no demonstrable offset.) Diagrams of one wall of each trench illustrating these features are included in an appendix. More detailed logging of fault trenches is in progress.

Data obtained from the study of the trenches are summarized in table 1. Trenches 1, 15, GA1A, and GA1B exposed faulted Tertiary bedrock at shallow depths and Quaternary deposits were thin or absent; these trenches were abandoned and are not reported in table 1. Nineteen trenches exposed surficial deposits that are believed to range in age from 7,000-9,000 years old (unit Q1c) to as much as 2 m.y. old (unit QTa) (Hoover and others, 1981). Six of these trenches also exposed Tertiary volcanic rocks.

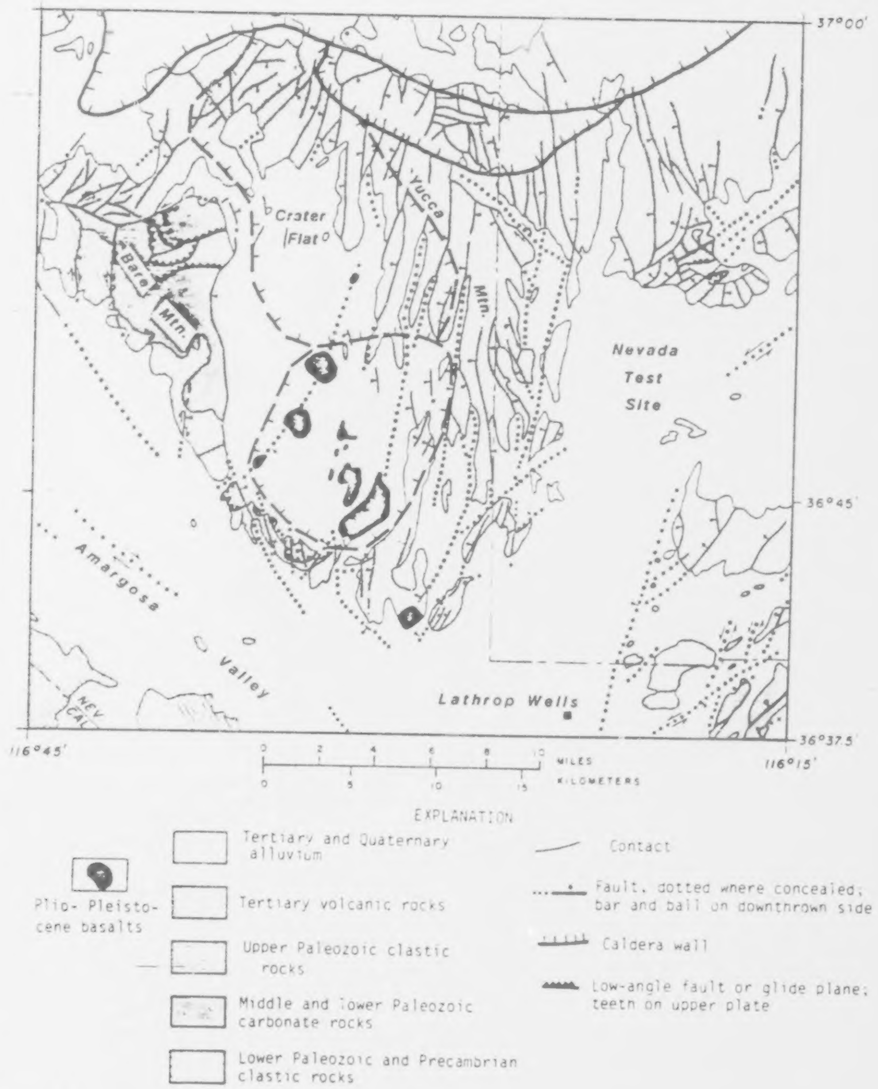

37°00'
36°45'
36°37.5'
116°45'
116°15'
Crater Flat
Yucca Mtn.
Bare Mtn.
Nevada Test Site
Amargosa Valley
Lathrop Wells
NEV CAL
0 2 4 6 8 10 MILES
0 5 10 15 KILOMETERS
EXPLANATION
Plio- Pleistocene basalts
Tertiary and Quaternary alluvium
Tertiary volcanic rocks
Upper Paleozoic clastic rocks
Middle and lower Paleozoic carbonate rocks
Lower Paleozoic and Precambrian clastic rocks
Contact
Fault, dotted where concealed; bar and ball on downthrown side
Caldera wall
Low-angle fault or glide plane; teeth on upper plate

Figure 2.--Generalized geologic map of the Yucca Mountain area. Modified from Snyder and Carr, 1982.

Table 1.--Data from trenches across faults in the Yucca Mountain area

Trench no.	Fault	Trench location	Surficial units exposed in trench	Bedrock exposed in trench	Tectonic features that affect surficial deposits	Inferred age of tectonic feature	Remarks
2	G	On projection of bedrock fault	Q1c, Q2a, Q2b, Q2c	No	None		Indicates no fault movement after 270,000 yr
4	F	do.	Q1c	No	do.	None	Indicates no fault movement after 7,000 yr
6	F	do.	Q1c	In trench floor	do.	None	Do.
8	Solitario Canyon	On QTa - bedrock contact	Q1c, QTa	In upthrown block	Faults cut QTa; fractures cut QTa and QTa soil	1.2 m.y.	Fault movement dated by basaltic ash in fault zone
9	F	On projection of bedrock fault	Q1c, Q2c	In upthrown(?) block	None	None	Indicates no fault movement after 270,000 yr
10A	Solitario Canyon	do.	QTa	No	do.	None	Probably not located on fault
10B	Solitario Canyon	On QTa - bedrock contact	Q2c, QTa	In upthrown block	QTa faulted against Tv, QTa soil and Q2c not faulted	<2 m.y., >270,000 yr	-----
11	D	On projection of bedrock fault	Q2b, Q2c, QTa	No	None	None	Indicates no fault movement after 270,000 yr
12	E	On trace of bedrock fault	Q2 soil	In upthrown and downthrown block	Q2 soil buries fault scarp in bedrock	<40,000 yr	Indicates no fault movement after 40,000 yr
13	H	On projection of bedrock fault	Q2b, Q2c	No	None	None	Indicates no fault movement after 270,000 yr
14	C	On Q2 - bedrock contact	Q2a, Q2s	In upthrown block	Fractures cut Q2s and Q2s soil, do not cut Q2a	$<270 \pm 90 \times 10^3$ yr, $>30 \pm 10 \times 10^3$ yr	Ages of Q2s and Q2a by uranium-trend method
16	Paintbrush Canyon	On projection of bedrock fault	Q2e	No	None	None	Probably not located on fault
16B	Paintbrush Canyon	do.	Q2e, Q2s	In upthrown block	Fractures cut Q2e, do not cut Q2s	<700,000 yr, >270,000 yr	-----
17	Painthrush Canyon	do.	Q2e	do.	None	None	Indicates no fault movement after 700,000 yr
A1	Painthrush Canyon	do.	Q2e, Q2b	No	Fractures cut Q2e and Q2e soil, do not cut Q2b	<about 700,000 yr, >160,000 yr	-----
A2	Paintbrush Canyon	do.	Q2b, Q2c	No	Fractures cut Q2c, not Q2c soil or Q2b	<800,000 yr, >270,000 yr	-----
CF1	M	On scarp in QTs	Q2, QTa	No	Faults cut QTa, do not cut some QTa soil horizons of Q2	1.2 m.y.	Fault movement dated by by basaltic ash in fault zone
CF2	Q	do.	Q2, QTa	No	3 faults cut QTa and lower part of QTa soil, 1 fault cuts entrie QTa soil, Q2 not cut	<2 m.y., >40,000 yr	Two periods of faulting likely
CF3	Q	On projection of scarp in QTa	Q2a, Q2c	No	Faults cut Q2c and Q2c soil, not Q2a	$<270 \pm 30 \times 10^3$ yr, $>40 \pm 10 \times 10^3$ yr	Ages of Q2c and Q2a by uranium-trend method

Five trenches (8, 10B, CF1, CF2, and CF3) exposed evidence of Quaternary offset and four other trenches (14, 16B, A1, and A2) exposed fractures in Quaternary units. These fractures parallel the faults on which the trenches are located, and are interpreted as fault related. The remaining 10 trenches showed no indication of Quaternary faulting. The evidence for Quaternary faulting derived from the trench studies is discussed in more detail below.

Where the trace of a fault plane was exposed in a trench wall, it was excavated by hand to search for slickensides and other directional features. None, however, were found. Neither the poorly consolidated Quaternary units nor the secondary carbonate deposits that commonly occur along the faults appeared to preserve such features. Slickensides associated with Quaternary faulting were observed only in an abandoned prospect pit along the Bare Mountain fault zone.

Stratigraphic units and post-fault carbonate and silica deposits were sampled in six trenches for isotopic age determinations. Sample locations are shown on trench diagrams in the appendix. Surficial deposits were dated by the uranium-trend method (Rosholt, 1980). This method is experimental but was used because materials needed for more conventional radiometric dating methods are sparse in the Yucca Mountain area. Dates determined by the uranium-trend method theoretically indicate the minimum age for deposition of surficial deposits (Rosholt, 1980). The technique is considered to be applicable for deposits that range in age from 5,000 to 900,000 years and has a potential estimated accuracy of about ±10 percent. Uranium-trend dates have been used in an attempt to determine minimum ages for deposits that structurally and stratigraphically bracket the age of fault related features in trenchs 2, 13, 14, and CF3. Approximate limits on the absolute age of faulting are inferred on the basis of these dates. The accuracy of the absolute ages derived by this method is not known, but ages determined for some stratigraphic units are reasonably consistent over the study area and are consistent with the broad limits on the ages of stratigraphic units in the study area inferred on the basis of correlations with better dated sequences from the surrounding region.

The uranium-series method (Szabo and others, 1981) was used to date deposits of carbonate or silica in trenches 14, CF1, and GA1A, interpreted as post-fault deposits. Uranium-series dates theoretically indicate the minimum age for the dated deposit, but the method only is considered to be accurate if the chemical system is closed. Most samples dated by this method yielded dates that appear to be inordinately young, but which can be considered as minimum ages (Szabo and others, 1981, p. 32). The dated samples from Yucca Mountain may not be from chemically closed systems, and the effect of this on the age determinations is not known. Dates determined by the uranium-series method are summarized in table 2.

Topographic profiles were measured across a number of fault scarps in the Crater Flat area, west of Yucca Mountain, to help characterize the scarps and possibly to provide a relative indicator of scarp age. Terms used in scarp descriptions are as defined by Bucknam and Anderson (1979).

LATE CENOZOIC STRATIGRAPHY

The late Tertiary and Quaternary deposits of the study area consist of alluvium, eolian sands, colluvium, lake sediments, and volcanic deposits.

Table 2.--Radiometric age data for fault-related secondary deposits exposed in trenches in the Yucca Mountain area

[Age determination by uranium-series method by P. O'Malley and B. Szabo, U.S. Geological Survey, written commun., 1982.]

Trench no.	Sample no.	Type of deposit	Age (in 10^3 yr)
14	TSV-412-1	Carbonate from K horizon Q2s soil	>400
		Opal from K horizon of Q2s soil	>350
	TSV-412-3	Opal from K horizon of Q2s soil	>550
	TSV-412-7	Opal from K horizon of Q2s soil	>400
CF1	TSV-386	Secondary carbonate along fault	27 ± 3
	TSV-387	K horizon of QTa	33 ± 4
GA-1A	TSV-395	Undisturbed carbonate deposit above fault	>32

These range in age from greater than 3 m.y. old for some of the lake sediments to less than about 150 years old for the youngest alluvial unit (Hoover and others, 1981). Hoover and others (1981) described the stratigraphy of these deposits (fig. 4) and defined characteristics by which they can be mapped and correlated across the region on the basis of age, lithology, and depositional environment. The following brief descriptions of the map units are based mainly on their work. More recently determined isotopic ages used to refine the stratigraphy reported by Hoover and others (1981) are summarized in table 3. The deposits are grouped herein into four major units: (1) late Pliocene and Pleistocene, (2) early Pleistocene and Pliocene(?), (3) middle and late Pleistocene, and (4) Holocene. The distribution of these units over the study area is shown on a generalized surficial map (pl. 1, in pocket).

Late Pliocene and Pleistocene Deposits

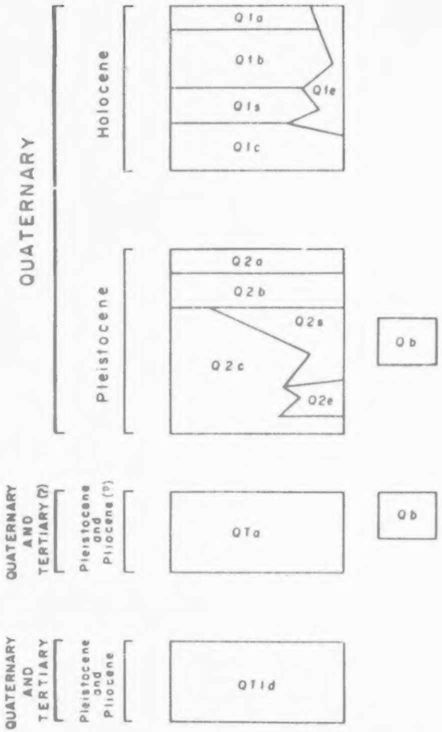
The oldest surficial deposits of the study are predominantly of late Pliocene age and consist of lacustrine sediments (fig. 4). These lacustrine deposits (unit QTld) are mainly unconsolidated to moderately indurated marl and silt that locally contain beds of limestone, sand, and fine-grained volcanic ash. They were deposited in Lake Amargosa, which occupied much of what is now the Amargosa Valley (fig. 1) during the late Pliocene; remnants of the lake probably persisted into the early Quaternary.

The age of unit QTld is not precisely known; however, an ash bed near the middle of the unit yielded radiometric ages that ranged from about 3 m.y. (fission-track method; C. W. Naeser, U.S. Geological Survey, written commun., 1980) to 3.8 m.y. (K-Ar method on biotite; R. L. Hay, University of California, Berkeley, written commun., 1979). A second ash bed near the top of the unit was dated at 2.1 ± 0.4 m.y. by the fission-track method (C. W. Naeser, written commun., 1982). A slightly younger age is suggested for the upper part of unit QTld by mammoth remains that are considered to be less than 2 m.y. old (C. A. Repenning, U.S. Geological Survey, written commun., 1982).

Early Pleistocene and Pliocene(?) Deposits

These deposits consist of alluvium that mainly is early Pleistocene but in some areas may be as old as latest Pliocene. The alluvium (unit QTa, fig. 3) consists of debris flows with sparse bedded fluvial sediments; it occurs as dissected fans and fan remnants that are adjacent to bedrock ranges and, less commonly, as isolated outcrops several kilometers from the ranges. Unit QTa typically is moderately indurated, coarse, angular, unsorted gravel with minor amounts of sand- to clay-size material. In most exposures, QTa is partly cemented with calcium carbonate.

The approximate age of unit QTa is limited by the ages of enclosing units; there are no dated materials within the unit. QTa unconformably overlies QTld at several localities in the Lathrop Wells quadrangle (Swadley, 1983), indicating that QTa deposits are less than 2 m.y. old in that area. Unit QTa is overlain by unit Q2e, that locally contains lenses of volcanic ash correlated with the Bishop ash by Izett (1982) on the basis of their similar chemistry. Radiometric dates for samples from the Bishop ash indicate that it is 0.74 m.y. old (Izett, 1982). The lower part of unit Q2e is considered approximately 0.74 m.y. old on the basis of the correlation with the Bishop ash. A period of erosion and weathering occurred following the deposition of QTa but prior to depostion of Q2e (Hoover and others, 1981), suggesting that


QUATERNARY
Holocene
Q1a
Q1b
Q1e
Q1s
Q1c
Pleistocene
Q2a
Q2b
Q2s
Q2c
Q2e
Qb
QUATERNARY AND TERTIARY (?)
Pleistocene and Pliocene (?)
QTa
Qb
QUATERNARY AND TERTIARY
Pleistocene and Pliocene
QTld

UNIT	ESTIMATED AGE RANGE (in years)
Holocene Deposits	
Q1a - Fluvial deposits	present to 150
Q1b - Fluvial deposits and debris flows	150 to 4000
Q1e - Eolian dunes and sheets	present to 8000
Q1s - Fluvial sand sheets	4000 to 7000
Q1c - Coarse fluvial deposits	7000 to 9000
Middle and Late Pleistocene Deposits	
Q2a - Local debris flows	≈40,000
Q2b - Fluvial deposits	160,000 to 250,000
Q2s - Fluvial sand sheets	270,000 to 700,000
Qb - Basalt flows and cinders	230,000 to 300,000
Q2e - Eolian dunes and sheets	700,000 to 750,000
Q2c - Coarse fluvial deposits	270,000 to 800,000
Early Pleistocene - Pliocene (?) Deposits	
QTa - Debris flows, minor fluvial deposits	11 X 10^6 to 2 X 10^6
Qb - Basalt flows and cinders	11 X 10^6 to 1.3 X 10^6
Pliocene - Pleistocene Deposits	
QTld - Lacustrine deposits	< 2 X 10^6 to 4 X 10^6

Figure 3.--Surficial units present in the NTS region. Modified from Hoover and others (1981). Estimated age ranges are based in part on radiometric data. Where data are not available, age limits have been estimated based on field relations, reconstruction of the depositional history, and correlations with dated units outside the NTS area.

Table 3.--Radiometric age data for stratigraphic units of the NTS region

[Ages shown are ± one standard deviation. Determinations by uranium-trend method by J. N. Rosholt except where otherwise indicated.]

Stratigraphic unit	Material	Sample location	Age (in 10^3 yr)
[1]Q1c	Charcoal in fluvial gravel	Amargosa River bank, 2 km SE of Beatty, NV	8.3 ± .075
Q	Clayey silt of eolian A horizon of Q2 soil	SW Frenchman Flat	30 ± 30
[2]Q2	Loess	Basalt cinder cone, 11 km NW of Lathrop Wells, NV	25 ± 10
Q2a(?)	Slope wash sand	Trench 14	38 ± 10
	Slope wash below fault scarp	Trench CF3	40 ± 10
	Slope wash	Trench 13	41 ± 10
	Fluvial gravel	Trench 2	47 ± 20
	Slope wash sand	Trench 14	90 ± 50
Q2b	Fluvial gravel	Trench 2	145 ± 25
	Fluvial gravel	Gravel pit near Shoshone, CA	160 ± 18
Q2s	Fluvial sand	Jackass Flats	160 ± 90
	Fluvial sand	Trench 14	270 ± 90
	Fluvial sand	Trench 14	420 ± 50
	Fluvial sand	Trench 14	480 ± 90
Q2c (younger soil)	Fluvial gravel	Trench 13	240 ± 50
	Fluvial gravel	Trench CF3	270 ± 30
	Fluvial gravel	South Crater Flat	260 ± 140
	Fluvial gravel	Jackass Divide	270 ± 35
	Fluvial gravel	Rock Valley	310 ± 30
Q2c (older soil)	Fluvial gravel	Jackass Divide	430 ± 40
	Fluvial gravel	South Crater Flat	430 ± 60
[3]Q2e	Eolian sand containing volcanic ash	Striped Hills	730
[4]QTld	Volcanic ash bed near top of lake beds	Carson Slough, south Amargosa Desert	2.1 ± 0.4 m.y.

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[1] ^{14}C analysis by S. W. Robinson, U.S. Geological Survey.

[2] Uranium-series analysis by B. J. Szabo, U.S. Geological Survey.

[3] Correlation on basis of trace element chemistry to Bishop ash; analysis by G. A. Izett, U.S. Geological Survey.

[4] Fission-track analysis by C. W. Naeser, U.S. Geological Survey.

QTa deposits may be substantially older than the 0.74 m.y. old limit implied by its stratigraphic position below Q2e deposits. Basalt ash deposits in fractures within unit QTa exposed in two fault trenches in eastern Crater Flat are inferred to be approximately 1.2 m.y. old on the basis of complex geological relationships discussed below, possibly restricting further the upper limit for the age of unit QTa (see discussion of trenches 8 and CF1).

Middle and Late Pleistocene Deposits

Middle and late Pleistocene deposits (unit Q2, fig. 3) consist of fan alluvium, fluvial and eolian sands, and volcanic deposits. These deposits have been subdivided into five mappable units on the basis of relative age and lithology: three alluvial units, Q2c, Q2b, and Q2a (in order of decreasing age); eolian dunes and sand sheets, Q2e, and fluvial sand sheets, Q2s (fig. 4). The lithologies, stratigraphic relations, and soil development of these units are described in more detail by Hoover and others (1981, p. 15).

Unit Q2c consists of fluvial fan deposits and some debris flows. These deposits typically are unconsolidated, poorly to well-sorted, nonbedded to well-bedded, angular to rounded gravel with sand and silt in the matrix. Interbeds of silty sand are locally common. Alluvial fans of Q2c are generally deposited on unit QTa on the middle and upper valley slopes; Q2c also occurs as terrace deposits in larger stream valleys.

Eolian deposits of unit Q2e occur as dunes and sand sheets in and adjacent to the Amargosa Valley. Ramps of fine, well-sorted sand as much as 50 m thick flank many of the hills bordering the Amargosa on the north. Unit Q2e is locally interbedded with the lower part of Q2c and is clearly older than Q2b.

Fluvial sand sheets of unit Q2s occur along major streams and along drainages downstream from dunes. The sheets consist of water-laid fine to medium gravelly sand or stream-reworked windblown sand and commonly rest on Q2c fans.

Unit Q2b is similar to Q2c in depositional environment and lithology. It occurs as terrace deposits that are inset in Q2c and underlies lower slope fans. These Q2b fans commonly merge upslope with Q2c fan deposits.

The youngest Q2 fluvial unit, Q2a, consists of debris flow deposits that are large enough to be mapped at only three localities. Q2a is poorly sorted, unconsolidated sand- to clay-size material that contains some gravel.

The inferred age of 0.74 m.y. old for lenses of volcanic ash in the lower part of unit Q2e discussed above is considered the approximate lower age limit for both units Q2e and Q2c. Younger Q2c gravels locally overlie and contain reworked cinders from a small basaltic volcano 11 km northwest of Lathrop Wells (fig. 1), which has yielded K-Ar dates ranging from 230,000 to 300,000 years old (Vaniman and others, 1982), indicating the approximate age for the younger part of Q2c deposition. A uranium-trend date of $270 \pm 30 \times 10^3$ years old was determined for a sample of Q2c from a soil horizon developed in the upper part of the unit. This date, which theoretically indicates the minimum age of Q2c deposition is consistent with the approximate age for the younger part of Q2c indicated by the relationship with the volcanic center near Lathrop Wells.

Uranium-trend dates determined for samples of Q2s in the Yucca Mountain area range from 480 ± 90 x 10^3 years to 270 ± 90 x 10^3 years. Stratigraphic relationships demonstrate that unit Q2s is equivalent in age to upper Q2c, in part equivalent to Q2e, and is older than Q2b. The minimum ages inferred from the uranium-trend dates are generally consistent with these stratigraphic relationships.

Samples of Q2b from the Yucca Mountain area have yielded uranium-trend dates that range from 145 ± 25 x 10^3 years to 160 ± 18 x 10^3 years (table 3). A minimum age of about 160,000 years for Q2b is preferred on the basis of the reliablity of laboratory results. Samples from four exposures of slope-wash and fluvial deposits that have been correlated with Q2a yielded uranium-trend dates that range from 38 ± 10 x 10^3 to 47 ± 20 x 10^3 years (table 3).

Holocene Deposits

Holocene deposits in the study area consist of fluvial sands and gravels and eolian sand. These deposits have been subdivided on the basis of relative age and lithology into five mapping units: three units of fluvial gravel, Q1c, Q1b, and Q1a (in order of decreasing age); fluvial sand sheets, Q1s; and dunes and eolian sand sheets, Q1e (fig. 4).

Unit Q1c consists of unconsolidated fluvial gravel and minor debris flows that typically are poorly to well-bedded, moderately well-sorted gravel having a sandy matrix; Q1c locally contains numerous thin beds of sand. Q1c occurs as thin, broad fans on Q2c downstream from the incised parts of stream channels on valley slopes and underlies terrace remnants along larger drainages. Charcoal fragments from Q1c fluvial sand and gravel near Beatty, Nevada (fig. 1), yielded a ^{14}C age of 8,300 ± 75 years (S. Robinson, U.S. Geological Survey, written commun., 1981).

Q1e consists of well-sorted fine sand that occurs as small dunes and irregularly shaped sheets over much of the Amargosa Valley. It has been observed overlying all other units. Unit Q1s consists of thin sheets of fine moderately well-sorted gravelly sand and commonly overlies Q1c. Q1b and Q1a consist of unconsolidated fluvial gravel and sand and are confined to the channels of active washes. The subunits of Q1 are described in more detail by Hoover and others (1981, p. 20).

LATE CENOZOIC FAULTING

Thirty-two faults with associated offsets or fractures in late Cenozoic deposits were indentified in the Yucca Mountain area on the basis of mapping and trench studies. The traces of faults that involve Quaternary deposits and their extentions in bedrock are shown on plate 1, along with several fault traces across which trenches were excavated but no disturbance of Quaternary deposits was recognized. The length of fault segments that have Quaternary offset cannot be determined in most cases, because materials necessary to demonstrate Quaternary offset are not present where faults extend into bedrock. The faults are described from east to west across the area; they are referred to by fault names where such names exist, otherwise a letter designation has been used to identify each fault or group of adjacent faults.

In the Calico Hills, in the northeastern part of the study area, four probable faults, collectively designated A on plate 1, form distinct linear features on aerial photographs and appear to offset unit QTa in outcrop. Three of these faults trend northeast and one trends eastward. The lineaments can be traced on aerial photographs across deposits of Q2c in some places, but do not cross Q1c deposits. No definite scarps were observed and offset of QTa is probably a half meter or less. It was not determined whether the lineaments in Q2c reflect vegetation growth controlled by fractures in QTa beneath undisturbed Q2c or offset of Q2c. None of the faults at this location were trenched.

Fault B, also in the Calico Hills, trends northeast and is exposed for less than 0.2 km in Paleozoic sedimentary rocks. It locally offsets deposits of QTa and Q2c, which are too small to show on plate 1. Offset, down to the southeast, is 2 m in QTa at the northeast end of the fault and about 0.5 m in Q2c at the southwest end. Fault B was not trenched, and it is not known whether the difference in the amount of offset is because of recurrent movement or a decrease in throw to the southwest.

The Paintbrush Canyon fault trends northward for 18 km in the eastern part of Yucca Mountain and continues to the north beyond the study area. Where it offsets Miocene volcanic rocks, the displacement is normal and down to the west. Although surficial mapping did not indicate Quaternary offset, evidence for disturbance of Pleistocene deposits was discovered in three trenches excavated across the fault (pl. 1). Trench A1 (fig. A15) exposed fractures in unit Q2e. These fractures do not appear to offset unit Q2b. In trench A2 (fig. A16), similar fractures cut unit Q2c but not the soil developed in Q2c or the overlying Q2b deposits. Because bedding features are scarce in these unconsolidated units, offset along the fractures was difficult to assess, but the lack of apparent disturbance adjacent to the fracture suggests any offset was minor, less than a few centimeters. Trenches 16 and 16B were cut near the southern end of the fault zone (north end of the Fran Ridge fault of Scott and Bonk, 1984) in deposits of unit Q2e. Trench 16 (fig. A12) showed no faults or fractures, but 16B (fig. A13) exposed carbonate-coated west-dipping fractures that cut Q2e but not overlying deposits of Q2s(?). The fracturing is interpreted as indicating minor offset on the fault in the underlying bedrock that produced fractures with no visible offset in the unconsolidated sand of unit Q2e.

Fault C (Bow Ridge fault of Scott and Bonk, 1984) parallels the Paintbrush Canyon fault (pl. 1) and also offsets Tertiary rocks down to the west. The fault trends northward for at least 6 km from the trench 15 site. It does not appear to cross Yucca Wash to the north, and its extent south of trench 15 is not known. No indication of Quaternary offset was detected by mapping of surficial deposits, but trench 14 exposed a fault in Tertiary volcanic rocks and fractures that cut across but do not appear to offset unit Q2s and the K horizon of the soil developed in it. These fractures do not cut the overlying Q2a (fig. A11). Uranium-trend dates determined for samples from units Q2s and Q2a in this trench are $270 \pm 90 \times 10^3$ years and $38 \pm 10 \times 10^3$ years respectively (table 3). Minor offset on fault C that produced the fractures in unit Q2s is inferred during the time interval between these dates. Uranium-series dates ranging from 350×10^3 to 550×10^3 years were determined for samples of carbonate and opal deposits (table 2) that extend across the faulted volcanic rocks without offset.

Along the northeast side of Yucca Mountain, four faults, D, E, F, and G, cut Tertiary volcanic rocks but, no offset of Quaternary deposits was observed. Each fault was investigated by one or more trenches (pl. 1). No evidence of Quaternary faulting was found. Data from these trenches are summarized in table 1 and trench wall diagrams appear in the appendix.

Fault I, near the south end of Yucca Mountain, cuts QTa and locally faults it against older Tertiary rocks. The fault strikes northeast and is down to the west; it was not trenched, and the amount of displacement is unknown. The fault is exposed for a distance of 2.4 km and appears to be covered by younger Q2 deposits to the north and south. A low northwest-facing scarp is exposed along part of the fault, but for most of its length, the downthrown block and the scarp are masked by windblown sand (Q2e) that locally extends across the fault without demonstrable offset.

The Solitario Canyon fault zone is one of the major structures of the Yucca Mountain area and marks the west boundary of the potential repository. The fault zone strikes northerly and extends for at least 12 km. Although the fault zone is complex, the net offset is normal and down to the west. Mapping of surficial deposits indicated several fault segments where QTa is faulted against Tertiary volcanic rocks for a total distance of 4.5 km (pl. 1).

Three trenches (8, 10A, and 10B) were cut in Quaternary deposits across the Solitario Canyon fault zone. Trench 8 exposed unit QTa displaced downward on the west against Tertiary volcanic rocks (fig. A4). The amount of offset is unknown. Reworked basaltic ash occurs in a fracture zone in unit QTa on the south wall of trench 8. Known late Cenozoic basaltic centers in the Crater Flat area, which are potential sources for the basaltic ash in trench 8, fall into three age groups on the basis of K-Ar dates. Basalt centers of the oldest group, approximately 3.75 m.y. old (Carr, 1982), are older than the maximum age for QTa interpreted from stratigraphic relations and isotopic dates from the Amargosa Desert and are not considered a possible source for the reworked ash. Differences between phenocryst compositions determined by microprobe analyses of samples of the 3.75 m.y.-old basalt and ash from trench 8 and a similar ash from trench CF1, 2 km to the west (pl. 1), also suggest that the 3.75 m.y.-old basalt eruptions were not the source of the ash in the trenches (Wolfsberg and Vaniman, 1984). The younger basalt centers in Crater Flat, approximately 1.2 and 0.24 m.y. old (B. M. Crowe, Los Alamos National Laboratory, written commun., 1984), cannot be distinguished by their phenocryst compositions, which are similar to compositions of reworked ash samples from both trenches (B.M. Crowe, Los Alamos National Laboratory, written commun., 1984). The reworked ash deposits in the fault trenches, therefore, cannot be uniquely correlated with either the 1.2- or 0.24 m.y.-old basalt sources on the basis of their phenocryst compositions.

The faulting and emplacement of the basaltic ash in trench 8 seem to have preceded the development of the K horizon of the QTa soil because the fault at the west edge of the fault zone does not offset the K horizon and the fracture that contains the ash appears to be sealed by carbonate where the fracture intersects the overlying K horizon. Fractures within the fault zone that cut across the K horizon without visible offset are probably related to later minor offset on the fault in the underlying bedrock. No deposits exposed establish a minimum age for these fractures.

Trench 10B, 3.3 km north of trench 8, exposes QTa faulted against Tertiary volcanic rocks (fig. A7). The amount of displacement of unit QTa is unknown. The K horizon of the QTa soil and the overlying Q2c deposit extend across the fault without offset. No displaced or fractured Quaternary deposits were exposed in trench 10A (fig. A6).

Uranium-series dates for unfractured calcrete deposits from the Solitario Canyon fault zone, where QTa is faulted against Tertiary volcanic rocks (sample localities 113 and 115, plate 1), were reported by Szabo and others (1981, p. 21-22), who interpreted the ages of the calcrete as greater than 5,000 years for locality 113 and greater than 20,000 and 70,000 years for two samples from locality 115). If this interpretation is correct, these dates could also represent minimum ages for lastest movements along parts of the fault zone because the calcrete was not fractured.

A fault designated H that is aligned with the Solitario Canyon fault zone, but is downthrown to the east, was investigated at the north edge of Yucca Mountain by trenches 13, GA1A and GA1B (pl. 1). Deposits of Q2c in trench 13 are not faulted (table 1). Carbonate deposits from an unfaulted soil overlying faulted Tertiary volcanic rocks in trench GA1A yielded a minimum uranium-series age of 32,000 years (table 2). No evidence confirming Quaternary movement was found.

Near the southern end of the Solitario Canyon fault zone, a possible fault, J, forms a northeast-trending 0.5-km-long lineament between QTa and Tertiary volcanic rocks. No offset could be demonstrated and no scarp is present where the lineament crosses QTa.

West of the Solitario Canyon fault zone, two parallel faults, K and N, trend generally north-northeast and are 7.5 and 6 km long, respectively. Both fault QTa down to the west against Tertiary volcanic rocks and are overlain locally by unfaulted deposits of Q1c. These faults were not trenched, and no data are available on the amount of Quaternary offset.

Fault L is exposed for less than 0.5 km in QTa along the east side of Crater Flat. The fault is marked by a north-northwest-trending brush line but does not display a scarp; it was not trenched and the direction and amount of offset are unknown.

Fault M consists of two segments that are not continuous on aerial photographs but are considered to be one fault because of alignment and similarities in the scarps. The northern segment trends north-northwest and is about 1 km long. It displaces QTa down to the west. The scarp is 1.5 m high and has a maximum slope angle of 7^{0}. The southern segment cuts unit QTa for a distance of 1.5 km, trends north and northwest and is marked by a west-facing scarp 1.5 m high. The scarp has a slope of 9^{0} and a surface offset of 1 m. Trench CF1, excavated across the scarp, exposed three faults that offset a QTa soil horizon about 2.5 m down to the west adjacent to the fault zone (fig. A17).

Basaltic ash occurs along one of the faults in trench CF1 and appears to have been emplaced in an open fracture that formed at the time of faulting. Because near-surface open fractures in poorly consolidated alluvial deposits are assumed to be short-lived features, it is probable that faulting of unit

QTa, the eruption of the basalt ash, and deposition of the ash in the open fracture essentially were contemporaneous. As discussed above, this ash is similar in composition to both the 1.2- and 0.24-m.y.-old basalts in the Crater Flat area. Although it was not possible to correlate uniquely the basaltic ash from the trench with basalt sources of either age on the basis of their composition, stratigraphic and structural relations suggest that the ash present in the fault zone is from the 1.2-m.y. old eruptions. A 1- to 2-m-thick K horizon (K_1 on fig. A17) interpreted by Swadley and Hoover (1983, p. 7-8) as post-dating the offset along the fault zone in trench CF1 contains stage III to stage IV carbonate development. A 1-m-thick pedogenic carbonate horizon developed on unit Q2c gravel exposed in nearby trench CF3 (fault Q, 2.5 km south of CF1) contains only stage II carbonate. The stage III to IV carbonate developed across the fault zone in trench CF1 is considered to be significantly older than the stage II carbonate on Q2c in trench CF3. A date of 0.27 ± 0.03 m.y. determined by the uranium-trend method for samples from the carbonate horizon developed on Q2c in trench CF3 theoretically indicates the minimum age for the deposition of the Q2c deposit (Swadley and Hoover, 1983). The K horizon thought to post-date the fault in trench CF1 is interpreted as older than the Q2c deposit in trench CF3 and, therefore, older than the 0.24 m.y.-old basalts. It is concluded on the basis of these relationships that the ash in the fault zone in trench CF1 was erupted during the 1.2 m.y.-old basalt cycle and faulting in trench CF1 is coeval with these eruptions. It can be concluded through a similar line of reasoning that the unfaulted K horizon exposed in trench 8 on the Solitario Canyon fault also is older than the 0.24 m.y.-old basalt, and the ash and fault zone exposed in that trench are also approximately 1.2 m.y. old.

To the west the short, poorly defined fault O cuts QTa and can be traced across an adjoining area of QTa that is thinly covered with Q2c gravel. The fault is indicated by a 0.5-km-long north-northwest-trending brush line, but does not form a scarp. No stratigraphic data are available on the amount of offset because the fault was not trenched.

Approximately 2 km southwest of fault M, two intersecting faults, designated P and Q occur chiefly in unit QTa. Fault Q, to the west, extends for 0.9 km in a north-northeast direction. It is marked by a scarp 1 to 4 m high where it crosses QTa. Two trenches, CF2 and CF3, were excavated across this fault. Trench CF2 (fig. A18), cut across the scarp, exposed the main fault and three minor faults. The amount of offset on these faults could not be determined because of a lack of bedding features in QTa. Three faults offset QTa but do not offset the upper part of the K horizon developed in QTa. A minor fault, 1 m east of the main fault, cuts the upper part of the K horizon and indicates a period of faulting younger than that of the main fault. A topographic profile measured near trench CF2 gave a maximum scarp slope angle of 12^o, a scarp height of 4 m, and a surface offset of 1.5 m. Trench CF3 was excavated 300 m south of CF2 in Q2 deposits where no scarp is present but the fault is marked by a poorly developed brush line. CF3 revealed three small faults that offset Q2c less than 1 m down to the west but do not offset an overlying Q2a deposit (fig. A19). Uranium-trend dates determined for samples from this trench are $270 \pm 30 \times 10^3$ years for unit Q2c and $40 \pm 10 \times 10^3$ for Q2a, suggesting that movement occurred during the time interval between these two dates.

Fault P, to the east, trends northwest across QTa for 0.35 km and is recognized by the presence of a subtle brush line; no fault scarp was found. The fault trace is concealed by Q2 deposits to the north and south, and fault P may be somewhat longer than indicated by surface expressions. The fault was not trenched and the amount of offset is unknown.

At the southwest end of Yucca Mountain, fault R offsets QTa against Tertiary volcanic rocks for a distance of 1.3 km. The fault continues to the south for about 2.5 km where it offsets Tertiary volcanic rocks or is concealed by Q2 deposits. The segment that offsets Quaternary deposits strikes north-northeast and is downthrown to the west. The fault was not trenched.

Fault segment S probably connects with a fault that extends for 11 km to the north through Tertiary volcanic rocks. The segment that cuts Quaternary deposits is 1.1 km long and offsets only unit QTa. This segment is marked by a poorly developed brush line. Although no definite scarp was found where the fault trace crosses QTa, deposits of Q2c, which are too small to show on page 1, appear to have been deposited along the east side of the fault against an east-facing scarp. If this interpretation is correct, it suggests that the Quaternary offset on this segment of the fault is down to the east, which is the opposite of the offset demonstrated by Tertiary volcanic rocks exposed along the fault to the north (pl. 1). The fault was not trenched, and the amount of offset is unknown.

Northeast of fault S, a north-northeast-trending fault, designated T, faults QTa and also displaces QTa against Tertiary volcanic rocks. It is 7 km long and is downthrown to the west. The fault was not trenched, and the amount of offset is unknown. A profile measured where the fault offsets QTa gave a maximum scarp slope angle of 11^{0}, scarp height of 1 m, and a surface offset of 0.7 m.

A short northeast-trending fault segment, designated U, near the southwest end of Yucca Mountain appears to displace QTa down to the west against Tertiary volcanic rocks although actual displacement of QTa could not be determined. The scarp is exposed for only 0.2 km but the fault can be traced on areal photographs for another 0.3 km to the southwest where it is partly obscured by Q1c deposits (pl. 1). The fault was not trenched; and no data are available on the amount of throw.

Fault V, located 1.5 km northeast of Black Cone in Crater Flat, has a north-northwest trend and extends for 1 km across an area of QTa. A very low east-facing scarp that is present only along part of the fault suggests that offset is down to the east. Where the fault trace crosses thin terrace deposits of subunit Q2c (pl. 1) the trace is visible on aerial photographs. It is not known whether this lineament reflects plant growth controlled by fractures in the underlying QTa or faulting in Q2c. The fault was not trenched, and the amount of Quaternary offset is unknown.

Near the north end of Bare Mountain there is a group of seven short, subparallel faults with a north-northeast trend. These faults collectively designated W on plage 1, cut QTa or offset QTa against an older Tertiary gravel unit. They range in length from 0.2 to 1.0 km, and several can be traced on aerial photographs across areas where QTa is covered by thin deposits of Q2c that do not appear to be offset. These faults were not trenched, and there are no data on the amount of offset; for most the sense of motion is unknown.

Northwest of location W an arcuate fault, designated X, is exposed chiefly in an area underlain by Tertiary gravel but locally cuts a narrow deposit of QTa. The fault is 2.5 km long. The southern part trends east-west and swings sharply to a north-northeast trend. No scarp was observed where the fault cuts QTa.

Fault Y, near the western edge of Crater Flat, is exposed for only 0.2 km in unit QTa. The fault trends north-northeast and is recognized by a brush line. No scarp is present but a cutbank exposure indicates that the offset is down to the east. The fault trace is concealed to the south by deposits of Q2c.

The Bare Mountain fault zone is a major structural feature of the area and marks the western edge of Crater Flat. It trends generally north and is about 20 km long. Although the fault is concealed for much of its length, evidence of Quaternary offset is exposed at several locations. Along the northern segment of the zone (BM-1, plate 1) QTa is faulted down against Paleozoic rocks. Locally Q2c fan deposits appear to cross the fault without offset. A prospect pit in dense secondary carbonate and opal deposits along the fault zone exposed a number of subparallel fault planes that dip 50° to 60° east. Slickenslides on one of these planes showed only dip-slip movement. A scarp profile measured near the southern end of this segment where the fault trace crosses an area of QTa, gave a slope angle of 10°, a height of 1 m, and a surface offset of 0.8 m.

To the south (segment BM-2) the fault trace can be identified only where it crosses two small areas of QTa. The fault is recognized by a brush line but no scarp is present. A cut bank exposure in QTa revealed that the fault plane dips 75° to the east.

The southern segment, BM-3, exposes faulted QTa at two locations and also exhibits geomorphic evidence of Quaternary movement. At the southern location the fault has formed a well-defined scarp in QTa. A scarp profile measured here gave a slope angle of 20°, a height of 4 m, and a surface offset of 1.7 m. At the second location, an area of QTa is truncated by the fault but the downthrown block is covered by Q1 age deposits and no scarp was observed.

Along the southern segment of the fault zone, fans composed of Q1c fluvial gravel at several locations occur adjacent to but 10 to 30 m above small remnants of Q2c fans that appear to be faulted against Paleozoic bedrock. Commonly Q1c overlies Q2c or is inset into Q2c fans. The juxtaposition of Q1c deposits well above Q2c fans is interpreted as indicating uplift along this segment of the fault zone after Q2c deposition. The uplift elevated the bedrock valleys that were the source of the Q1c gravels and resulted in deposition of fans at elevations above the older Q2c deposits. These Q1c fans extend into the bedrock valleys on the upthrown side of the fault and cross the fault without offset. The fault has not been trenched, but the relative positions of Q1c and Q2c deposits indicate Quaternary uplift could be in the range of 10 to 30 m along the southern part of the Bare Mountain fault zone.

SUMMARY AND DISCUSSION

Offset or fracturing of Quaternary deposits was demonstrated for 32 faults within the Yucca Mountain study area. The fault segments for which Quaternary offset can be demonstrated range in length from 16 km, the Bare Mountain fault zone, to less than 0.5 km. The longest continuously exposed scarp in Quaternary deposits is a 4-km segment located near the south end of the Solitario Canyon fault zone.

For most faults the amount of Quaternary offset has not been determined. Where offset can be measured or where fault scarps are preserved, dip-slip movement on the order of 3 m or less is indicated. The one exception is the southern segment of the Bare Mountain fault zone where geomorphic evidence suggests Quaternary offset may be in the range of 10 to 30 m.

Strike-slip movement could not be demonstrated nor could such movement be ruled out. The poorly consolidated surficial deposits exposed in the trenches and the secondary carbonate deposits along the trace of faults are poor mediums for the preservation of slickensides and other small-scale directional features. Strike-slip offset on the order of tens of meters would probably be detected by geomorphic evidence such as offset of streams or other linear features, whereas offset of a few meters or less probably could not be detected.

Although absolute age data are limited, faults with Quaternary displacement can be divided into three broad age groups. The youngest group consists of faults B, C, Q, the Paintrbrush Canyon fault, and the Bare Mountain fault zone; these faults offset or produced fracturing in deposits of Q2 age. Based on uranium-trend age determinations as discussed above, age brackets of less than 270,000 ± 90,000 yr and greater than 38,000 ± 10,000 yr and less than 270,000 ± 30,000 yr and greater than 40,000 ± 10,000 yr have been inferred for faults C and Q, respectively. Offset on the Paintbrush Canyon fault after about 700,000 yr and before 270,000 yr is suggested by correlation of stratigraphic units where fracturing is exposed in trenches A1 and A2. Quaternary offset on the southern part of the Bare Mountain fault zone is inferred during the interval between 270,000 and 9,000 yr ago based on geomoprhic evidence and stratigraphic correlations. Movement on fault B after 270,000 yr is inferred from the minimum age of the youngest offset unit, Q2c; no minimum age of offset has been determined for this fault.

Faults of the intermediate age group offset only QTa and older units; where these faults are exposed in areas of QTa, a distinct scarp is commonly observed. Only general age constraints can be inferred for Quaternary offset along faults of this group. Quaternary movement of the Solitario Canyon fault zone and fault M has been tentatively dated at about 1.2 m.y. ago based on occurrences of basaltic ash in the fault zones as discussed above. Inferred age brackets for Quaternary offset on fault I are less than 2 m.y., based on the maximum age inferred for unit QTa and greater than about 700,000 yr, the approximate minimum age inferred for Q2e deposits that appear to extend across the fault scarp without offset. Fault T is included in the intermediate group because the height and slope angle of the scarps of faults T and M are similar. Based on preliminary scarp measurements, faults in Crater Flat have been classified as significantly older than 1.2 m.y. where no scarp is preserved or about 1 m.y. old or younger for faults that exhibit scarps similar in height and slope angle to fault M, tentatively dated at 1.2 m.y. old. In this preliminary study, comparisons have been limited to scarps of similar height (1-2 m) and scarps formed in the same rock type (unit QTa). For these comparisons it is assumed that the fault offset included some scarp-forming component.

The 23 faults of the oldest group offset QTa and older units, but no scarps are preserved. General age limits for Quaternary offset on faults of this group are younger than 2 m.y., the maximum age inferred for unit QTa, and older than about 1.2 m.y., inferred from the lack of preserved scarps. Minimum age constraints are demonstrated for some faults of the oldest group where stratigraphic units younger than QTa overlie a fault without offset. Faults S, V, and Y and faults P and R are locally overlain by apparently unfaulted deposits of Q2c and Q2b, respectively. Minimum age limits for Quaternary offset of greater than 270,000 yr and greater than 160,000 yr are inferred for these two groups of faults from the minimum ages of the overlying stratigraphic units. Fault group A and faults K, N and U are overlain in places by unfaulted Q1c deposits and a minimum age limit for Quaternary offset of greater than 7,000 yr is inferred. No minimum age limit can be demonstrated by this method for faults J, L, X, and fault group W. Table 4 summarizes the data on each fault and the inferred ages of offset.

Where age constraints have been inferred from radiometric dating and from stratigraphic correlations of faulted and unfaulted deposits at a trenched site, no offset younger than about 40,000 yr has been demonstrated. Holocene offset has not been demonstrated in the study area nor can it be ruled out.

Table 4.--Summary of Quaternary faulting in the Yucca Mountain area

Fault or fault group[1]	Trench number	Youngest unit faulted or fractured[2]	Oldest unit not faulted or fractured	Inferred age of last movement	Method of dating	Remarks
A (4)	not trenched	QTa	Q1c	$<2 \times 10^6$ $>7,000$	Correlation of stratigraphic units	-----
B	do.	Q2c	Unknown	$<270,000$	do.	No minimum age determined
Paintbrush Canyon fault	A1, A2, 16, 16B	Q2e (fractures in trench A2)	Q2c soil (in trench A1)	$<700,000$ $>270,000$	do.	----- -----
C	14	Q2s (fractures in trench 14)	Q2a	$<270 \pm 90 \times 10^3$ $>38 \pm 10 \times 10^3$	Uranium-trend	-----
D	11	No Quaternary offset found	QTa	-----	-----	No evidence of Quaternary offset
E	12	do.	Q2 soil	-----	-----	Do.
F	4, 6, 9	do.	Q2c	-----	-----	Do.
G	2	do.	Q2c	-----	-----	Do.
Solitario Canyon fault zone	8, 10, 10B	QTa	QTa soil	1.2×10^6	Petrographic correlation of of basalt ash; correlation of stratigraphic units	-----
H	13, GA1A, GA1B	No Quaternary offset found	Q2c	-----	-----	-----
I	Not trenched	QTa	Q2e	$<2 \times 10^6$ $>700,000$	Correlation of stratigraphic units	-----
J	do.	QTa	Unknown	$<2 \times 10^6$	do.	>1.2 m.y. age inferred from lack of scarp
K	do.	QTa	Q1c	$<2 \times 10^6$ $>7,0000$	do.	Do.
L	do.	QTa	Unknown	$<2 \times 10^6$	do.	>1.2 m.y. age inferred fr lack of scarp
M	CF1	QTa	Q2 soil	1.2×10^6	Petrographic correlation of basalt ash; correlation of stratigraphic units	-----
N	Not trenched	QTa	Q1c	$<2 \times 10^6$ $>7,000$	Correlation of stratigraphic units	>1.2 m.y. age inferred fr lack of scarp
O	do.	QTa	Q2c(?)	$<2 \times 10^6$ $>270,000(?)$	do.	Do.
P	do.	QTa	Q2b(?)	$<2 \times 10^6$ $>160,000(?)$	do.	Do.
Q	CF2, CF3	Q2c	Q2a	$<270 \pm 30 \times 10^3$ $>40 \pm 10 \times 10^3$	Uranium-trend	Two episodes of faulting; younger episodes dated trench CF3
R	Not trenched	QTa	Q2b(?)	$<2 \times 10^6$ $>160,000(?)$	Correlation of stratigraphic units	-----
S	do.	QTa	Q2c	$<2 \times 10^6$ $>270,000$	do.	-----
T	do.	QTa	Unknown	$<2 \times 10^6$	do.	1 m.y. or younger age inferred from scarp
U	do.	QTa	Q1c	$<2 \times 10^6$ $>7,000$	do.	>1.2 m.y. age inferred from lack of scarp
V	do.	QTa	Q2c(?)	$<2 \times 10^6$ $>270,000(?)$	do.	Do.
W ~~(3)~~	do.	QTa	Unknown	$<2 \times 10^6$	do.	Do.
X (7)	do.	QTa	Unknown	$<2 \times 10^6$	do.	Do.
Y	do.	QTa	Q2c	$<2 \times 10^6$ $>270,000$	do.	Do.
Bare Mountain fault zone	do.	Q2c	Q1c	$<270,000$ $>9,000$	Correlation of stragigraphic units and geomorphic evidence	-----

[1] Number of faults in group shown in parenthesis.
[2] Unit shown is faulted except where fractures are indicated.

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APPENDIX

Preliminary diagrams of nineteen trenches excavated in the Yucca Mountain area to evaluate Quaternary fault movement.

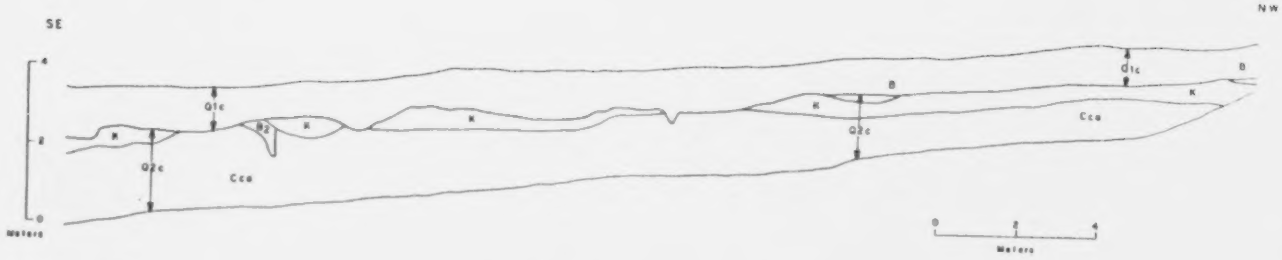

Figure A1.--Diagram of south wall of trench 2. Trench trends N. 60° W. across the projection of fault G. Mapped in May 1982 by Swadley, L. D. Parrish and H. E. Huckins, Fenix & Scisson (F&S). Samples of Q2a and Q2b dated by uranium-trend method (table 1) were collected from north wall from strata not preserved in south wall. Sample location is opposite southeast end of diagram.

Unit	Description
Q1c	Gravel, sandy, unconsolidated, mostly pebbles with scattered cobbles; poorly bedded to nonbedded
Q2c	Gravel, mostly pebbles and cobbles with scattered boulders, poorly sorted, poorly bedded. Soil developed in Q2c consists of B, B2, K, and Cca horizons
B	B horizon, light-brown, cambic, developed in poorly sorted gravel
B2	Similar to B with threads and filaments of carbonate minerals
K	K horizon--poorly sorted gravel with stage III carbonate development
Cca	Cca horizon--poolry sorted gravel with stage I carbonate development

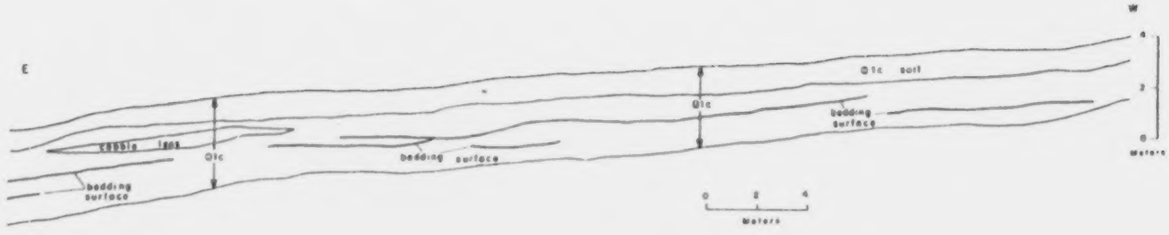
E
W
Qlc soil
Qlc
Qlc
Qlc
cobble lens
bedding surface
bedding surface
bedding surface
0 2 4
Meters
4
2
0
Meters
25

Figure A2.--Diagram of south wall of trench 4. Trench trends N. 85° W. across the projection of fault F. Mapped in June 1982 by Swadley.

Unit	Description
Qlc	Gravel, angular, poorly sorted, poorly bedded; sandy matrix and scattered sand lenses; mapped bedding surfaces are poorly defined and discontinuous, may be scour surfaces. Weak soil development in unit, lower contact of soil mapped at base of Cca horizon (stage I carbonate development)

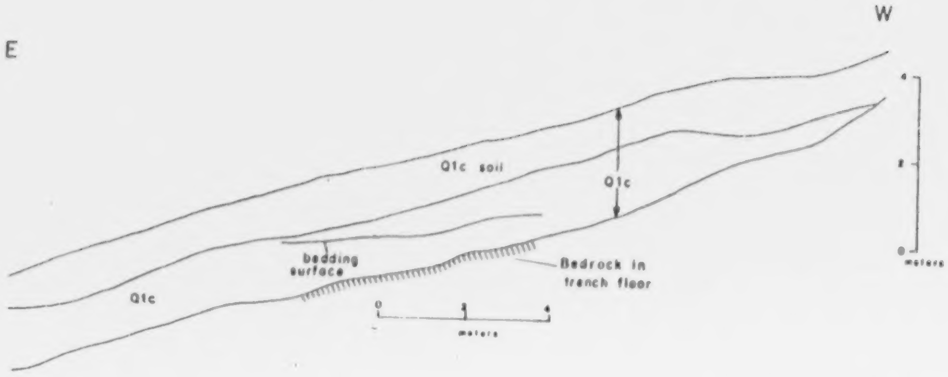
E
W
Qlc soil
Qlc
Qlc
bedding surface
Bedrock in trench floor
0
2
4
meters
0
2
4
meters

Figure A3.--Diagram of south wall of trench 6. Trench trends N. 70° W. across the projection of fault F. Mapped in June 1982 by Swadley and H. E. Huckins.

Unit	Description
Qlc	Gravel, sandy, angular, poorly sorted, poorly bedded; mostly pebbles and cobbles with scattered boulders. Weakly developed soil; lower contact mapped at base of Cca horizon (stage I carbonate development)

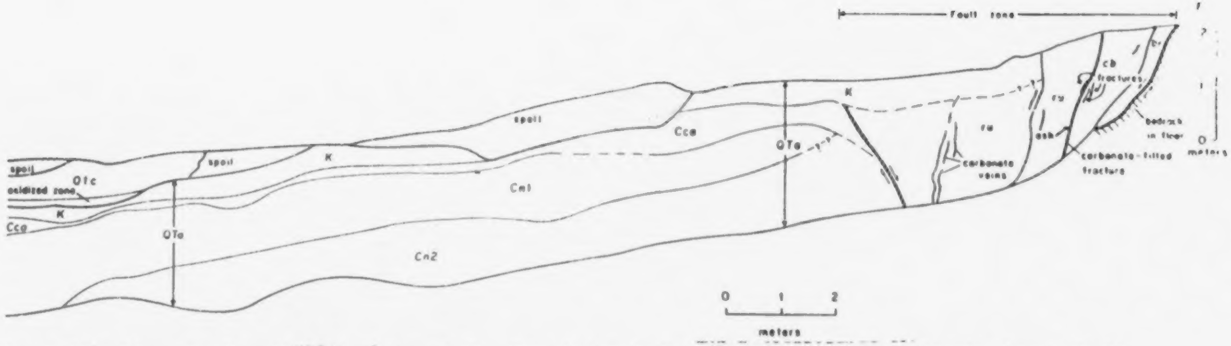
Fault zone
spoil
Qlc
oxidized zone
K
Cca
QTa
spoil
K
spoil
Cca
Cn1
Cn2
QTa
K
ru
ru
ash
cb
fractures
br
carbonate veins
carbonate-filled fracture
bedrock in floor
?
1
0
meters
0
1
2
meters

Figure A4.--Diagram of north wall of trench 8. Trench trends N. 80° E. across the Solitario Canyon fault zone. Mapped in November 1982 by Swadley and H. E. Huckins. QTa is displaced against Tertiary volcanic rocks by main fault at east end of trench. Minor fault at west edge of fault zone cuts QTa but not the K horizon developed in QTa. Later fracturing extends into and through the K horizon.

Unit	Description
Qlc	Gravel, sandy, unconsolidated, angular, poorly sorted
QTa	Gravel, coarse, angular, poorly sorted, soil developed in QTa consists of K, Cca, Cn1 and Cn2 horizons
K	K horizon--poorly sorted angular gravel with stage IV carbonate development; thin laminated zone at top. Oxidized zone at west end of trench consists of weathered fragments of K horizon in a matrix of reddish-brown sand
Cca	Cca horizon--angular poorly sorted gravel with stage III to II carbonate development
Cn1	Gravel, angular, moderately well sorted, mostly pebbles and small cobbles
Cn2	Gravel, coarse, angular, poorly sorted
br	Breccia, with abundant laminated opaline carbonate along main fault.
cb	Carbonate, porous and some fault breccia with scattered plates of laminated carbonate and brown opal
ru	Rubble and unsorted gravel, cemented with porous, secondary carbonate. Carbonate increases to the east across fault zone, locally it obscures the K horizon in this unit
Ash	Location of loose 1.2 m.y.-old basaltic ash along fracture in opposite wall of trench

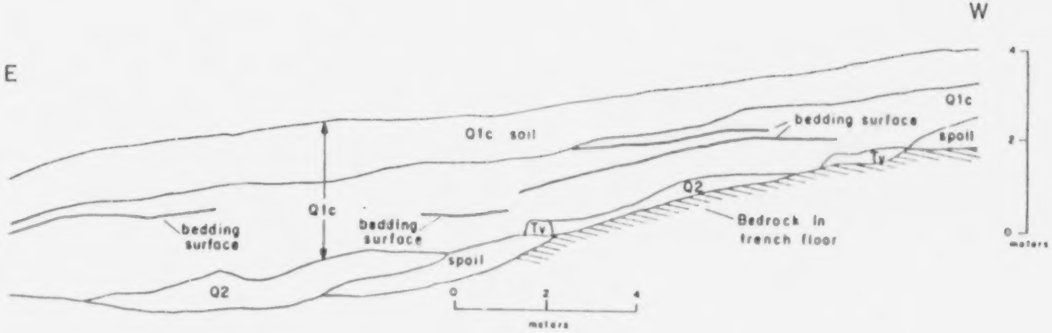
E
W
Q1c soil
Q1c
bedding surface
spoil
Tv
Q2
Bedrock in trench floor
Q1c
bedding surface
bedding surface
spoil
Tv
Q2
0
2
4
meters
0
2
4
meters

Figure A5.--Diagram of south wall of trench 9. Trench trends N. 65° W. a ross projection of fault F. Mapped in June 1982 by Swadley and H. E. Huckins.

Unit	Description
Q1c Soil	Soil--weakly developed in sandy poor sorted gravel. Lower contact marked by base of stage I carbonate development
Q1c	Gravel, angular, poorly sorted, poorly bedded; pebble-cobble gravel with scattered boulders; sandy, silty matrix. Bedding surfaces shown are poorly defined and discontinuous, may be scour surfaces
Q2c	Gravel, angular, poorly sorted, nonbedded
Tv	Tertiary volcanic rocks--welded tuff, also exposed in trench floor

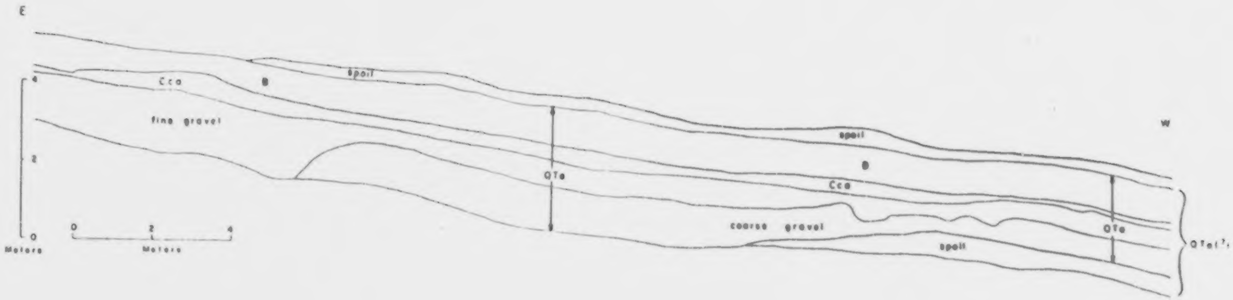
E
W
4
2
0
Meters
0
2
4
Meters
Cca
B
spoil
fine gravel
QTa
spoil
B
Cca
coarse gravel
spoil
QTa
QTa(?)

Figure A6.--Diagram of south wall of trench 10A. Trench trends N. 80° E. across a projection of the Solitario Canyon fault zone. Mapped in April 1983 by Swadley and H. E. Huckins.

Unit	Description
QTa(?)	Gravel--consists of a coarse cobble to boulder unit that is unsorted and nonbedded overlain by a sandy, angular pebble to cobble gravel that is poorly sorted and poorly to moderately well bedded. Soil developed in unit consits of B and Cca horizons
B	B horizon--cambic, light-brown; 0.2-0.3 m thick; may include younger slope wash unit at top
Cca	Cca horizon--developed in poorly sorted sandy gravel, stage II to III carbonate development

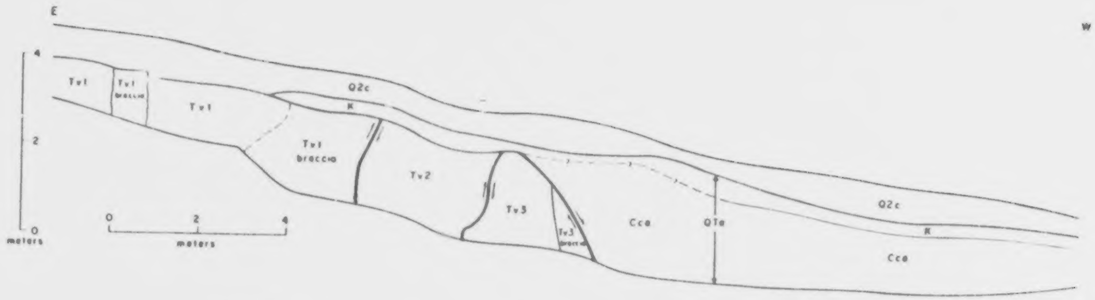

Figure A7.--Diagram of south wall of trench 10B, Solitario Canyon fault zone. Trench trends N. 80° W. Mapped in April 1983 by Swadley and H. E. Huckins. Fault at west edge of fault zone offsets QTa against Tertiary volcanic rocks. K horizon, developed in faulted QTa, and the overlying Q2c extend across the fault without offset.

Unit	Description
Q2c	Gravel, angular, poorly sorted, sandy matrix. Soil (not mapped separately) consists of light-brown cambic B horizon and a stage II Cca horizon
QTa	Gravel, coarse, poorly sorted, sandy matrix; cemented with stage III to IV carbonate development.
K	K horizon--gravel, angular, sandy matrix; cemented with stage III to IV carbonate development
Cca	CCa horizon--gravel, angular, poorly sorted; sandy, tuffaceous matrix; stage II carbonate development
Tv1	Tuff, welded, purplish-brown
Tv2	Vitrophyre, black
Tv3	Tuff, slightly welded, light-brown

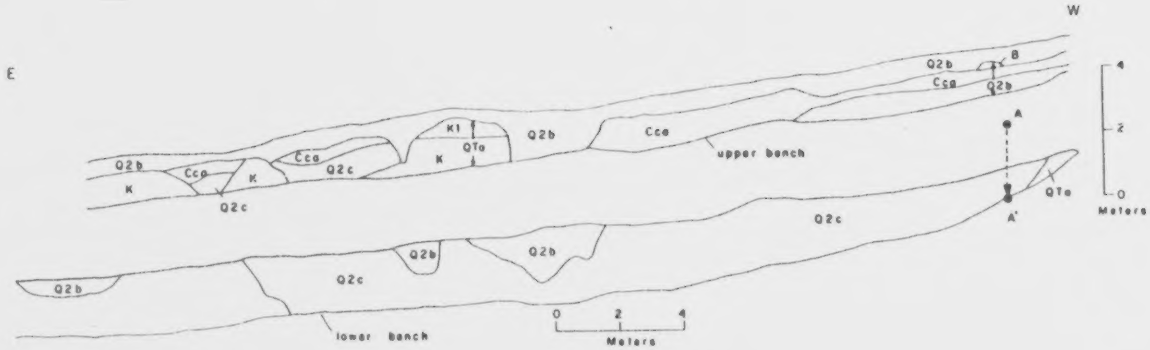
E
W
Q2b
K
Cca
Q2c
Cca
Q2c
K
K1
QTa
K
Q2b
Cca
upper bench
Q2b
B
Cca
Q2b
A
A'
QTa
4
2
0
Meters
Q2b
Q2c
Q2b
Q2b
Q2c
lower bench
0
2
4
Meters

Figure A8.--Diagram of south wall of trench 11. Trench trends N. 75° E. across projection of fault D. Mapped in June 1982 by Swadley and H. E. Huckins. Trench cut on two levels, upper bench is 2-3 m wide. For clairty, lower level of cut has been displaced from A to A' in this figure.

Unit	Description
Q2b	Gravelly sand, gravel is mostly angular pebbles with scattered cobbles. Soil horizons (not mapped) consist of yellowish-brown cambic B horizon and thin stage I Cca horizon
Q2c	Gravel, angular, poorly sorted, non-bedded, sandy matrix; includes pebble- to boulder-size clasts. Soil horizons developed in Q2c consist of B and Cca horizons
B	B horizon--yellowish-brown, cambic; developed in sandy, poorly sorted gravel
Cca	Cca Cca horizon--stage I to II carbonate development in poorly sorted gravel
QTa	Gravel, angular, unsorted, nonbedded Soil developed in unit consists of K and Cca horizons
K	K horizon--stage III to IV carbonate development in unsorted gravel
K1	Laminated part of K horizon
Cca	CCa horizon--stage II carbonate development in unsorted gravel

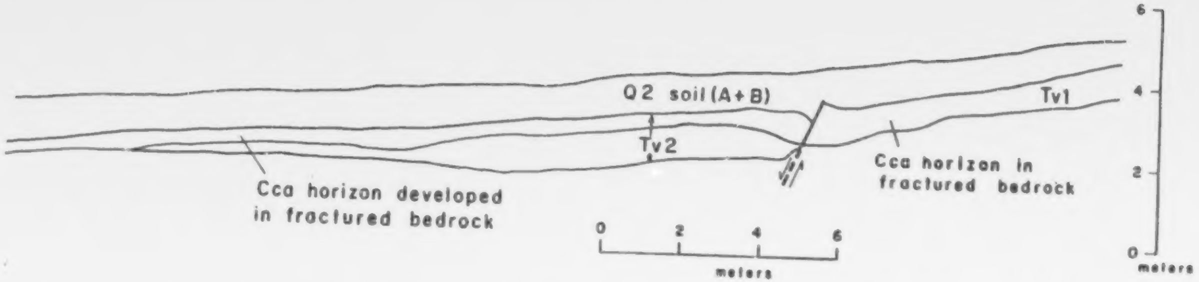
Q2 soil (A+B)
Tv1
Tv2
Cca horizon developed in fractured bedrock
Cca horizon in fractured bedrock
0
2
4
6
meters
6
4
2
0
meters

Figure A9.--Diagram of northwest wall of trench 12. Trench trends N. 45° E. across trace of fault E. Mapped in June 1982 by Swadley and H. E. Huckins.

Unit	Description
Q2 Soil	Soil developed across existing fault in bedrock, probably in eolian and slope wash deposits. No offset is apparent in soil. Soil development consists of thin A horizon and light-brown cambic B horizon (not mapped)
Tv1	Grayish-red welded tuff. Where exposed above trench floor includes common to abundant carbonate as coatings and fracture fillings.
Tv2	Dark-gray, platy-weathering welded tuff. Upper part of exposure in trench wall includes common to abundant carbonate as coatings and fracture fillings

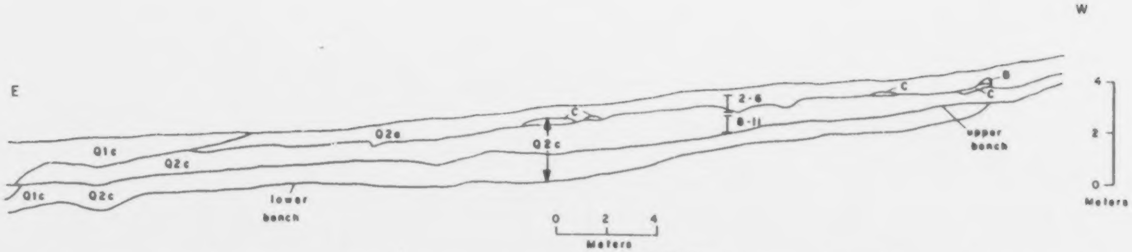

Figure A10.--Diagram of south wall of trench 13. Trench trends N. 50° E. across projection of fault H. Cut on two levels, upper bench is 1-1.5 m wide. Mapped in June 1982 by Swadley and H. E. Huckins. Sample locations for uranium-trend age determinations shown by bar

Unit	Description
Q1c	Gravel and sand, unconsolidated, poorly sorted non bedded
Q2b	Gravelly sand, poorly sorted; gravel chiefly pebbles with few cobbles. Soil development consists of yellowish-brown cambic B horizon and thin stage I Cca horizon (not mapped)
Q2c	Gravel, angular, poorly sorted, poorly bedded; sandy matrix; well consolidated. Exposed soil development in unit consists of B and Cca horizons
B	B horizon--light-brown, cambic. Single small remnant exposed
Cca	Cca horizon--poorly sorted sandy gravel with stage II carbonate development

Radiometric Ages

Sample No.	Unit	Age (in 10^3 yr)
YM13-2 thru 6	Q2a	41±10
YM13-8 thru 11	Q2c	240±50

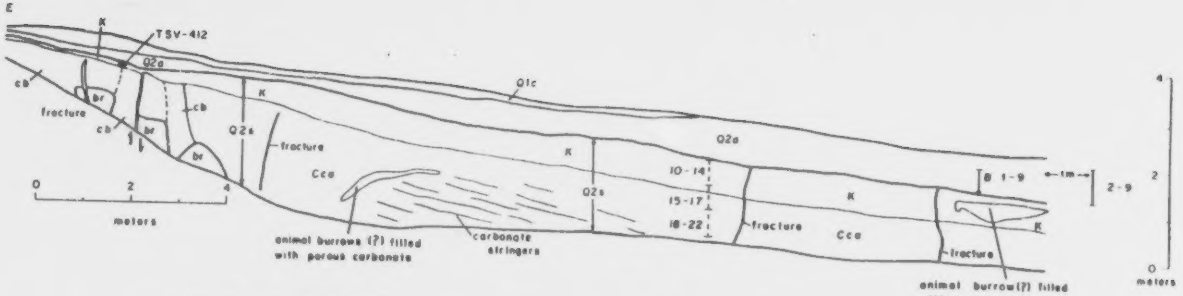
E
K
TSV-412
Q2a
cb
br
fracture
cb
br
cb
br
Q2s
K
fracture
Cca
Q1c
K
Q2a
Q2s
10-14
15-17
18-22
fracture
K
Cca
B 1-9
1m
2-9
fracture
K
0
2
4
meters
animal burrows (?) filled with porous carbonate
carbonate stringers
animal burrow(?) filled with porous carbonate
4
2
0
meters

Figure A11.--Diagram of south wall of trench 14. Trench trends east-west across the trace at fault C. Mapped in May 1982 by Swadley, L. D. Parrish, and H. E. Huckins. Fault offsets blocks of Tertiary volcanic rocks. Fractures cut Q2s and its soil but not the overlying Q2a. The K horizon that developed in Q2s extends across the fault without offset but is fractured (fractures too small to show on this figure) and fracture surfaces are coated with secondary carbonate immediately above fault. Animal burrow 5 m west of the main fault may have been dug along a fracture in Q2s. Sample locations for uranium-trend age determinations shown by bar; bar is dashed where location is projected from north wall. Sample location for uranium-series age determinations (sample TSV-412) shown by cross.

Unit	Description
Q1c	Sand, gravelly, unconsolidated
Q2a	Sand, gravelly, slightly indurated with clay
Q2s	Sand, gravelly. Exposed soil horizons developed in unit consist of K and Cca horizons
K	K horizon--sand, gravelly, stage III to IV carbonate development
Cca	Cca horizon--sand, gravelly, stage I to II carbonate development; carbonate stringers along bedding(?) surfaces
cb	Colluvium and breccia with abundant laminar opaline carbonate Laminae parallel fractures, soil horizons, and surfaces of large blocks in underlying breccia
br	Breccia and blocks of Tertiary volcanic rocks

Radiometric Ages

Sample No.	Unit	Age (in 10^3 yr)
YM 14-2 thru 9	Q2a	90±50
YM 14-10 thru 14	Q2s	270±90
YM 14-15 thru 17	Q2s	420±50
YM 14-18 thru 22	Q2s	480±90
YM 14 B-1 thru 9	Q2a	38±10
TSV-412-1	Q2s K horizon	>400 and >350
TSV-412-3	Q2s K horizon	>550
TSV-412-7	Q2s K horizon	>400

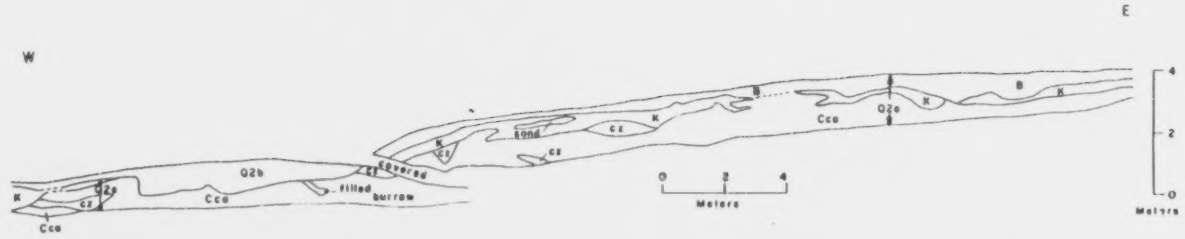
W
E
K
Cca
Q2e
cz
Q2b
Cca
filled
burrow
cz
covered
K
cz
sand
cz
cz
K
B
Cca
Q2e
K
B
K
0
2
4
Meters
4
2
0
Meters

Figure A12.--Diagram of north wall of trench 16. Trench trends N. 75° W. across a projection of the Paintbrush Canyon fault. Mapped in June 1982 by Swadley and H. E. Huckins.

Unit	Description
Q2b	Sand, poorly bedded, moderately well sorted; locally cemented with carbonate at base. Unit channels into underlying Q2e
Q2e	Eolian sand, fine, well sorted, nonbedded. Soil development consists of B, K, and Cca horizons
B	B horizon--light-brown, cambic, developed in well sorted fine sand
K	K horizon--stage III carbonate development in well sorted sand. Horizon is discontinuous, probably disrupted by burrows
Cca	Cca horizon--well sorted sand with stage I to II carbonate development. Root casts common to abundant. Includes local zones of carbonate enrichment (cz) that may be nonpedogenic

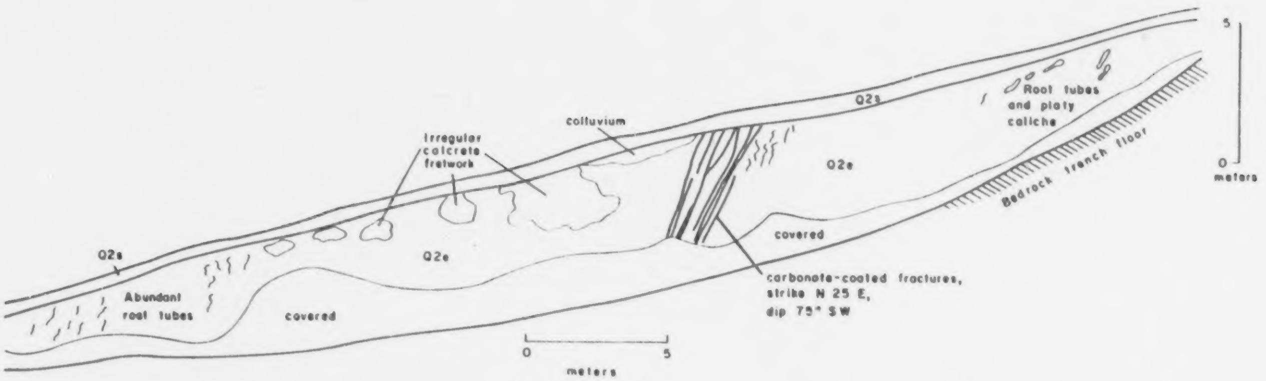
Q2s
Abundant
root tubes
covered
Q2e
Irregular
calcrete
fretwork
colluvium
carbonate-coated fractures,
strike N 25 E,
dip 75° SW
covered
Q2s
Q2e
Root tubes
and platy
caliche
Bedrock trench floor
0
5
meters
5
0
meters

Figure A13.--Diagram of north wall of trench 16B, located near the southern end of the Paintbrush Canyon fault. Mapped in February 1983 by W. J. Carr (USGS). Fractures cut unit Q2e but not overlying Q2s.

Unit	Description
Q2s	Sand, light-grayish-brown, and angular gravel. Probably a mixture of slope wash and colluvium
Q2e	Sand, eolian, well sorted, nonbedded; includes scattered clasts and lenses of colluvial gravel; root tubes and secondary carbonate deposits common. Q2e soil not preserved

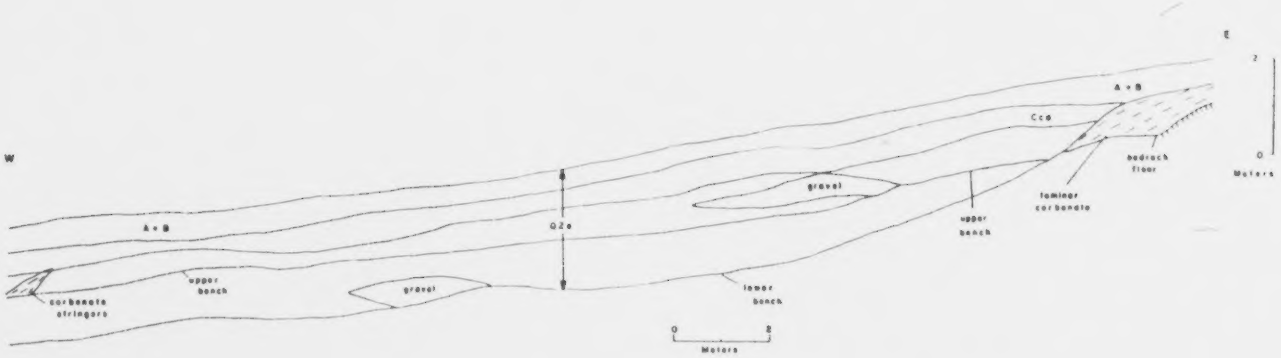
W
E
A+B
A+B
Cca
Q2e
gravel
gravel
upper bench
upper bench
lower bench
carbonate stringers
laminar carbonate
bedrock floor
2
0
Meters
0
8
Meters

Figure A14.--Diagram of north wall of trench 17. Trench trends N. 55^{0} W. across a projection of a branch of Paintbrush Canyon fault. Cut on two levels, upper bench is 1-2 m wide. Mapped in July 1983 by Swadley and L. D. Parrish.

Unit	Description
Q2e	Eolian sand, moderately well to well sorted, poorly consolidated, nonbedded; includes scattered clasts and lenses of colluvial gravel. Root casts locally common. Soil developed in unit consists of A, B, and Cca horizons
A+B	A and B horizons, undivided. A horizon is light-gray silt and clay; vesicular, preserved locally. B horizon is light brown, cambic
Cca	Cca horizon--stage II carbonate development in fine well-sorted sand

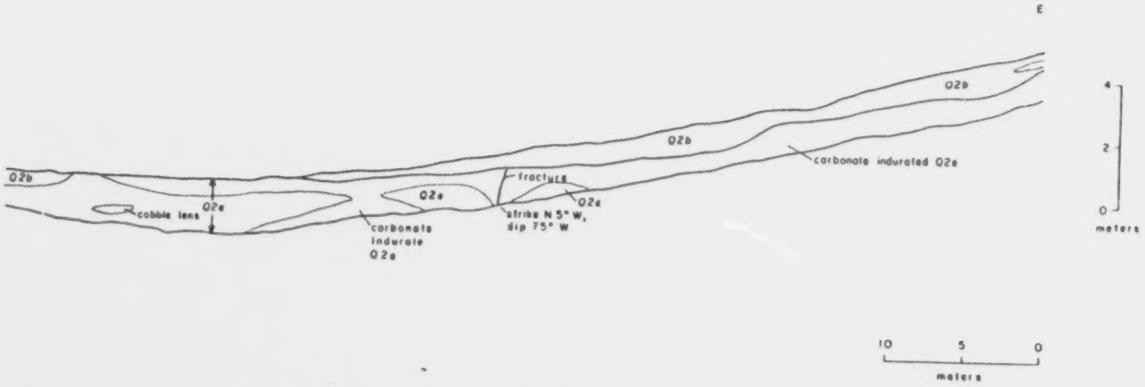
E
Q2b
Q2b
Q2b
Q2e
Q2e
Q2e
cobble lens
carbonate indurate Q2e
fracture
strike N 5° W, dip 75° W
carbonate indurated Q2e
4
2
0
meters
10
5
0
meters

Figure A15.--Diagram of north wall of trench A1, Paintbrush fault. Trench trends east-west. Mapped in 1979 by A. J. Gordon (F&S) and L. D. Parrish (F&S). Fractures cut unit Q2e and its soil but not the overlying Q2b.

Unit	Description
Q2b	Gravelly sand, probably a mixture of colluvium and slope wash. Soil horizons (not mapped) consist of light-brown cambic B horizon and stage II Cca horizon
Q2e	Eolian sand, well sorted locally includes pebbles and cobbles (colluvium). Root casts common. Sand is commonly moderately indurated with patchy areas of nonpedogenic carbonate (shown by stipple pattern). Soil development consists of thin stage III K horizon (not mapped)

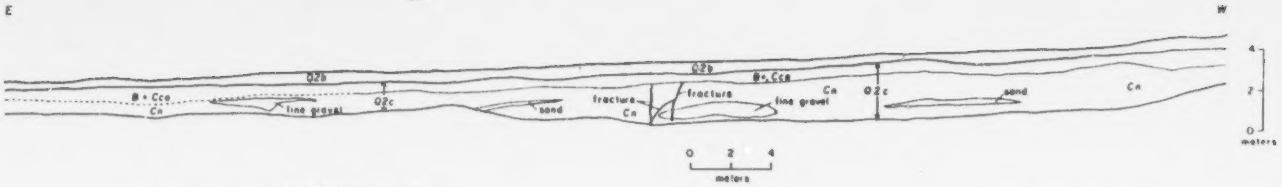
E
W
Q2b
B + Cca
Cn
fine gravel
Q2c
sand
fracture
Cn
Q2b
fracture
B+Cca
fine gravel
Cn
Q2c
sand
Cn
0
2
4
meters
4
2
0
meters

Figure A16.--Diagram of south wall of trench A2, Paintbrush Canyon fault. Trench trends N. 85° E. Mapped in July 1983 by Swadley and L. D. Parrish. Fractures cut unit Q2c but not its soil or the overlying Q2b.

Unit	Description
Q2b	Sandy gravel, probably a mixture of slope wash and colluvium
	Soil (not mapped) consists of a weak cambic B horizon and a stage I Cca horizon
Q2c	Gravel, sandy, poorly sorted, poorly bedded
B+Cca	B and Cca soil horizons undivided: B horizon is light brown, cambic; developed in sandy gravel; Cca horizon, stage II carbonate development in sandy gravel
Cn	Gravel, very sandy, poorly sorted, poorly bedded; coarse, with scattered boulders; well indurated; includes lenses of sand and fine gravel

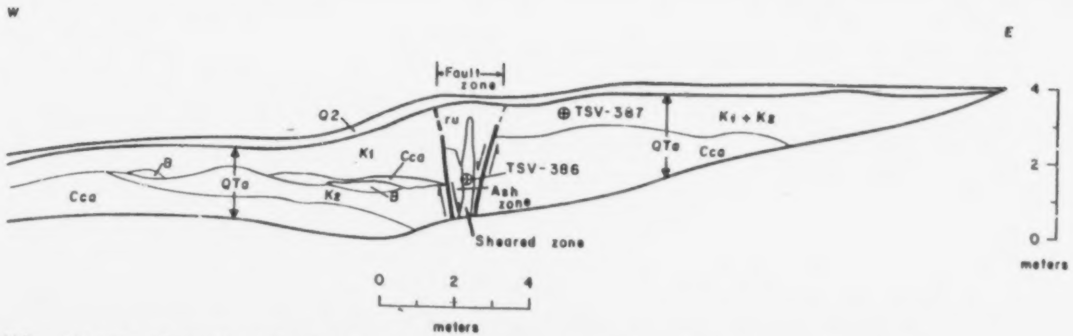

Figure A17.--Diagram of north wall of trench CF1, excavated across fault M. Trench trends east-west. Diagram modified from Swadley and Hoover (1983). Faults cut QTa and offset a pre-fault soil horizon (K2) down to the west. A post-fault soil horizon (K1) appears to overlie the fault without offset; however, the abundance of post-fault carbonate deposits in the fault zone partly obscures this horizon. Sample localities for TSV-386 and TSV-387 (table 2) are projected from the south wall of trench.

Unit	Description
Q2	Gravel, sandy, unsorted. Soil development consists of a clayey silt vesicular A horizon and a light-brown cambic B horizon (not mapped)
QTa	Gravel, coarse, angular, unsorted. Soil development in QTa includes four soil horizons described below
K1	K horizon--unsorted gravel, cemented with stage III to IV carbonate development; represents post-fault soil development. Anomalously thick K1 horizon shown west of fault zone is probably caused by nonpedogenic carbonate deposited in permeable material adjacent to the fault
CCa	Gravel, unsorted stage I carbonate development
B	B horizon--argillic, reddish-brown sand and gravel; remnant of pre-fault soil
K2	K horizon--gravel, unsorted; cemented with stage III to IV carbonate development. Represents pre-fault K horizon preserved in downthrown block; in upthrown block it merges upward with post-fault K1
Ash zone	Gravel containing stringers and pods of 1.2 m.y.-old basaltic ash
ru	Rubble and disturbed QTa gravel cemented with nonpedogenic(?) carbonate. Soil zones not recognized in fault zone because of abundant carbonate cement

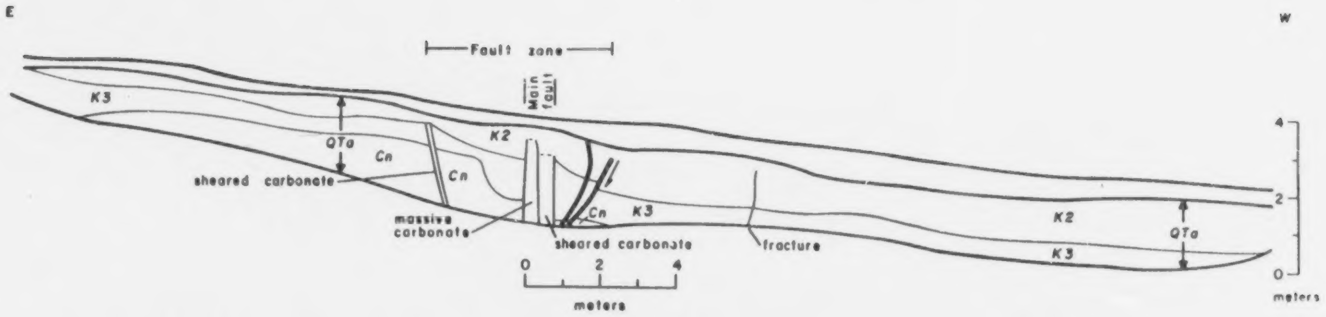
E
W
Fault zone
Main fault
K3
QTa
Cn
K2
sheared carbonate
massive carbonate
Cn
K3
sheared carbonate
fracture
0
2
4
meters
K2
QTa
K3
4
2
0
meters

Figure A18.--Diagram of south wall of trench CF2, located across fault Q. Trench trends N. 88° W. Diagram modified from Swadley and Hoover (1983). Four faults cut QTa but not the overlying Q2. The main fault and two minor faults do not extend through the K2 horizon indicating some soil development after faulting. One fault does cut the K2 horizon which suggests a later epidsode of faulting. The apparent displacement of the lower contact of the K horizons may be due to post-fault deposition of carbonate in permeable zones near the faults.

Unit	Description
Q2	Sandy gravel; soil development consists of light-gray vesicular silt and clay A horizon 5-20 cm thick; and a pale-yellowish-brown to pale-brown cambic B horizon developed in sandy gravel; 5-70 cm thick (not mapped)
QTa	Gravel, coarse, nonbedded, poorly sorted. Soil horizons mapped separately
K2	Gravel, well cemented with massive to laminated stage IV carbonate; 0-1.5 m thick
K3	Gravel, moderatley cemented with stage III carbonate; 0.5-1.5 m thick
Cn	Gravel, coarse, poorly sorted, nonbedded

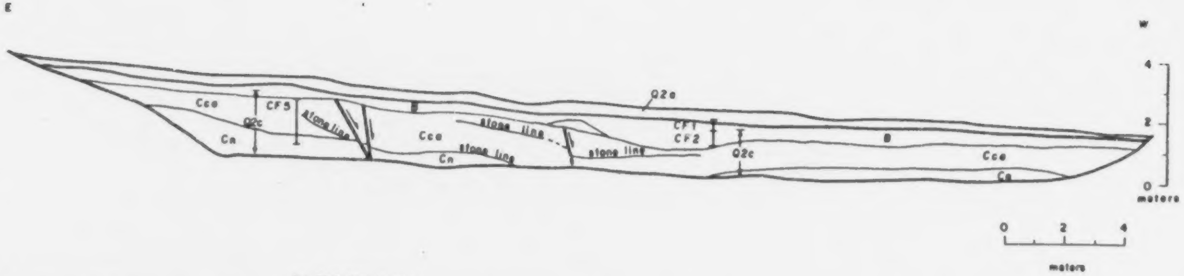
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Figure A19.--Diagram of south wall of trench CF3. Trench trends N. 83^0 W. across fault Q. Diagram modified from Swadley and Hoover (1983). Three faults cut unit Q2c and its soil but not the overlying Q2a. Sample locations for uranium-trend age determinations shown by vertical bar.

Unit	Description
Q2a	Sand, silty, some gravel. Probably largely slope wash deposits
Q2c	Gravel, sandy, poorly sorted. Soil development consists of B, Cca, and Cn horizons
B	B horizon--cambic, light-brown, developed in sandy gravel. As mapped, upper part of unit includes the B horizon of the overlying Q2a (20-45 cm thick). Where B is thick, west of main fault, it probably includes some colluvial sand
Cca	Cca horizon--gravel, sandy, stage II carbonate development
Cn	Gravel, sandy, poorly sorted, fairly well bedded

Uranium-trend Age Determination

Sample No.	Unit	Age (in 10^3 yr)
CF1	Q2a	40±10
CF2	Q2c	270±20
CF5	Q2c	260±140

Senator HECHT. The State of Nevada has praised your cooperative attitude, but has told me that there have been several instances where DOE headquarters in Washington has rejected agreements between your office and the State. Has this sort of thing happened? If so, how often?

Mr. VIETH. I think that you have to look at the Department as a homogenous group for this particular situation. I think the rejections of certain proposals have come as a collective view and should not be blamed on headquarters. I think that there are features in some of the things that the State has asked for that are negative features, so we have tried to give them a balanced perception from the Department on whether or not we should move forward with certain things.

I am not clear on places where headquarters and the field are that much differing in viewpoints about things.

Senator HECHT. Have you done any work on possible waste transportation routes to Yucca Mountain?

Mr. VIETH. We have the responsibility in the project office of looking at what are the routes within the State by which radioactive waste would be taken from the border to the site. We have looked at that in some detail.

Senator HECHT. Have you come up with any determination yet?

Mr. VIETH. We have identified alternate routes for highways and for rail routes, yes.

Senator HECHT. Would you mind submitting all that to us, too, please?

Mr. VIETH. We will be happy to provide that information to you.

[The information follows:]

QUESTION 2: Please specify, and provide detailed routes, maps of the routes, to be used to the repositories, WIPP and the MRS and identify the affected Indian lands, municipalities, towns, counties, and states that would lie along, or be in proximity to, the proposed routes of transportation of spent fuel and high-level and transuranic wastes to the 3 proposed repositories, to and from the MRS and to WIPP.

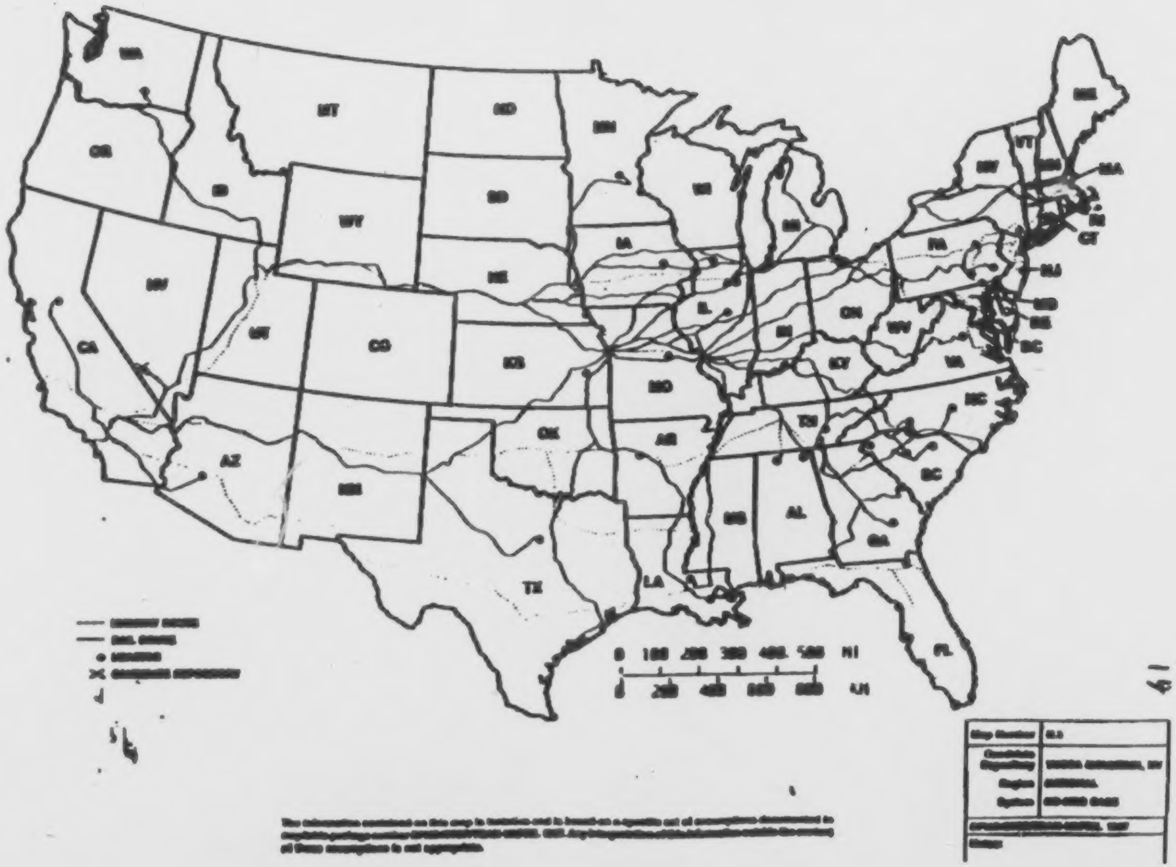
ANSWER: Figures 1 through 6 are maps that show possible routes for spent fuel shipments to each of the three candidate repository sites, for both the MRS and the no-MRS disposal systems. Please note that these are representative routes and do not represent any decision by the DOE as to actual shipment routes.

The DOE does not have available any maps identifying Indian lands along routes. However, when the Bureau of Indian Affairs (BIA) updates and republishes its map "Indian Land Areas - General" that uses 1971 information, we will incorporate the revised information into a map that includes Federal Indian Reservations and potential highway and rail routes through these jurisdictions. This new map should be available within the next few months; it will be provided to you at that time.

The routes for waste shipments to WIPP will comply with DOT routing regulations which include the most direct Interstate between the shipping sites and the WIPP facility. The DOE is currently discussing these Interstate routes with each affected State and Indian Tribe, and expects these discussions to be complete in 1988 prior to commencement of shipments. Please see Table 3 for a listing of potential States and Indian lands through which waste destined for WIPP will be transported.

POSSIBLE ROUTES FOR SPENT NUCLEAR FUEL SHIPMENT

Figure 1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POSSIBLE ROUTES FOR SPENT NUCLEAR FUEL SHIPMENT

Figure 2

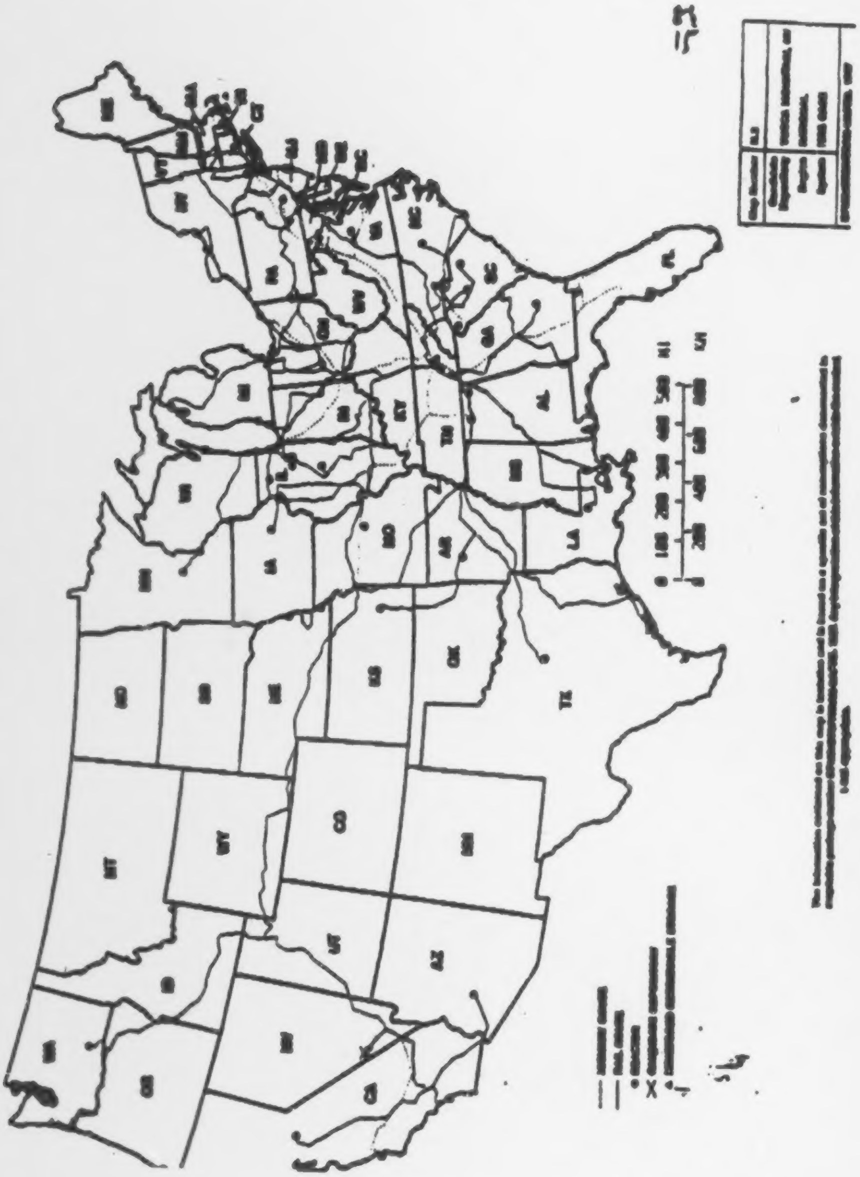

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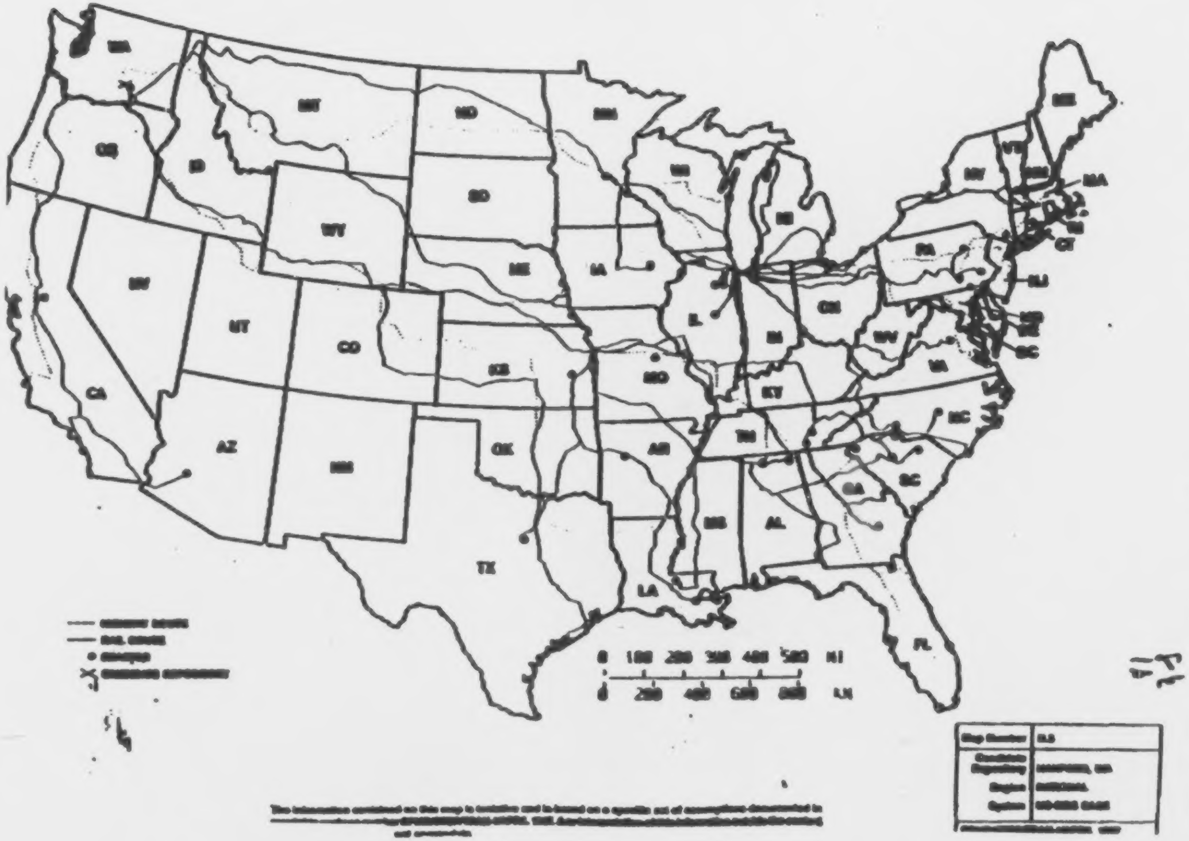
Figure 3

POSSIBLE ROUTES FOR SPENT NUCLEAR FUEL SHIPMENT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POSSIBLE ROUTES FOR SPENT NUCLEAR FUEL SHIPMENT

Figure 4

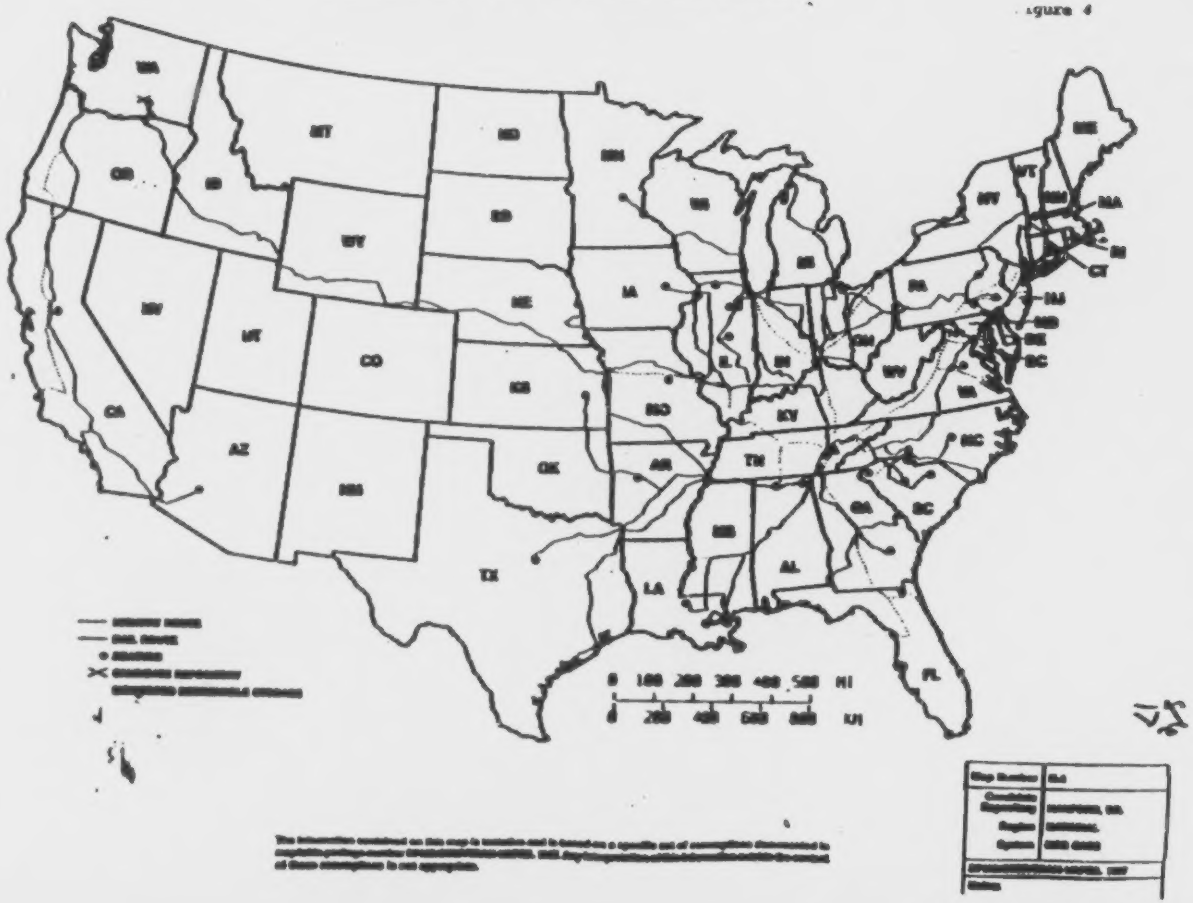
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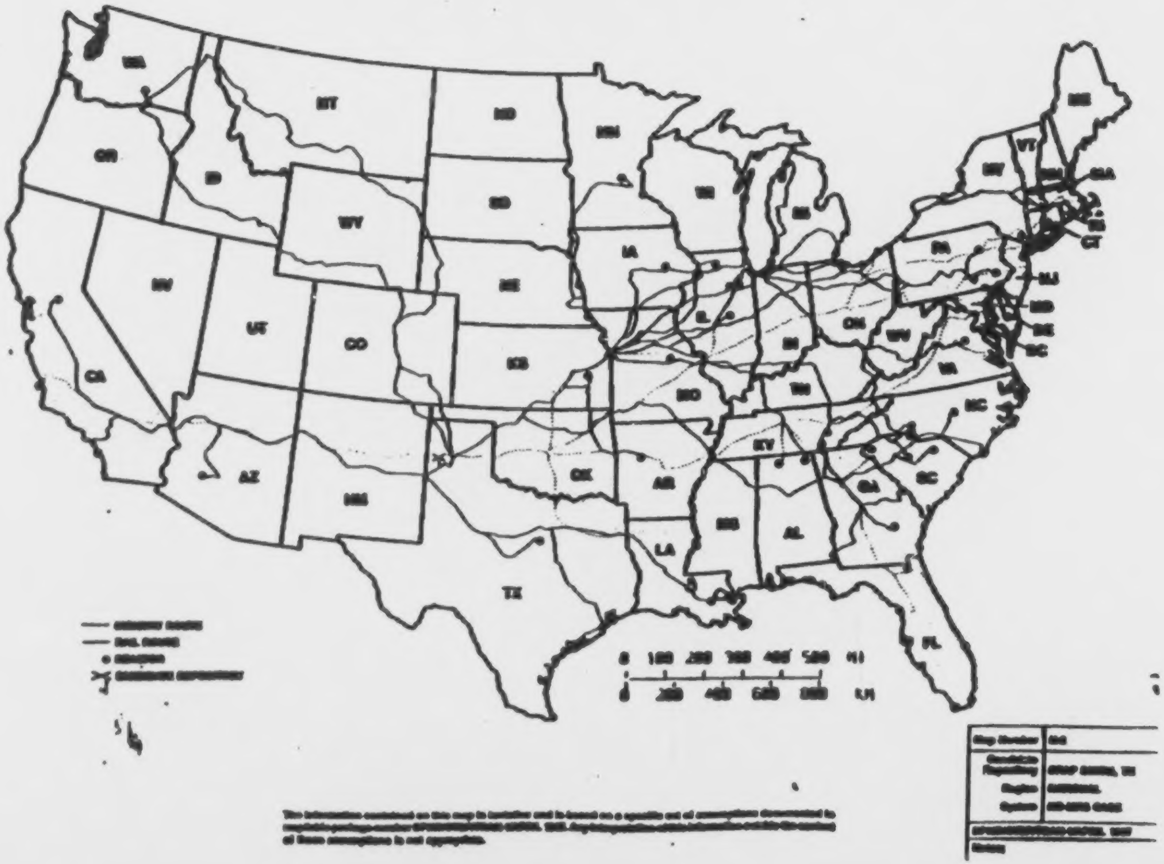
Figure 5

POSSIBLE ROUTES FOR SPENT NUCLEAR FUEL SHIPMENT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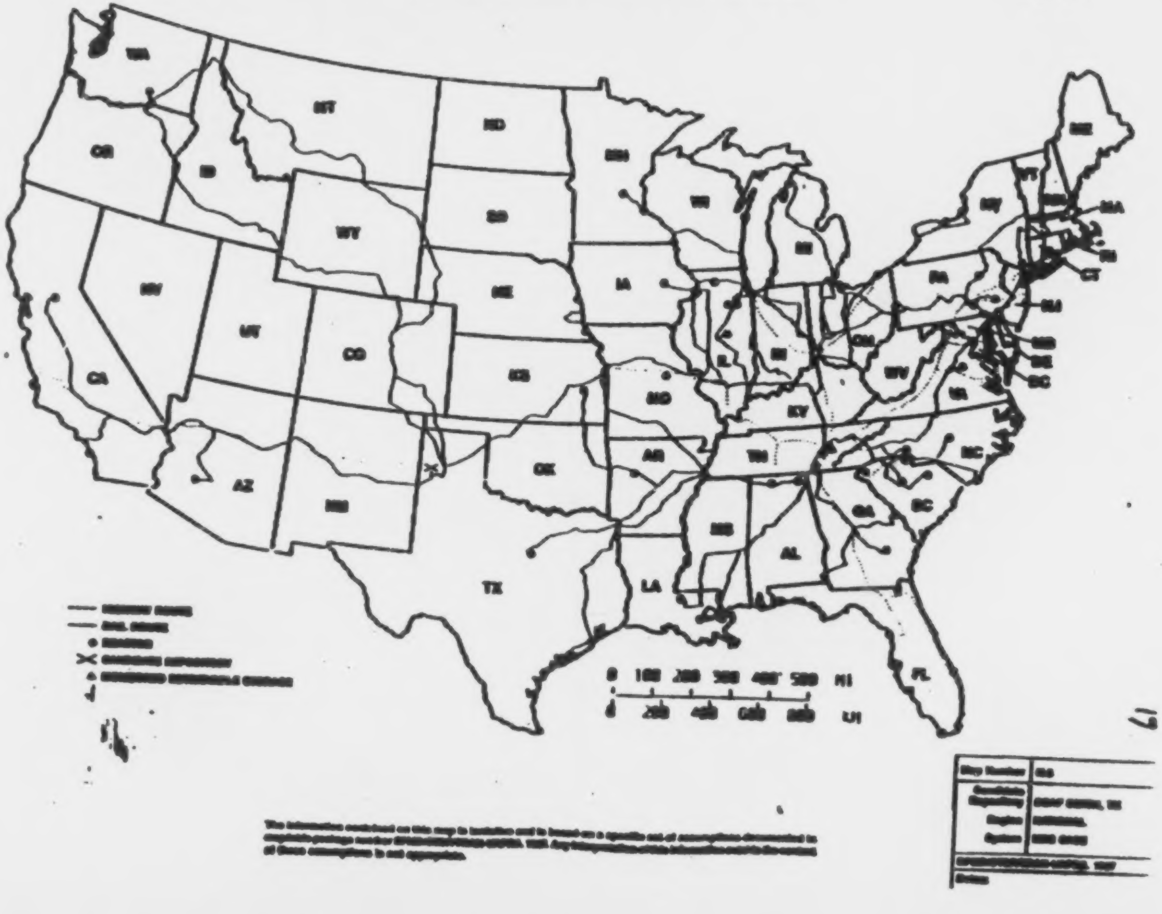
POSSIBLE ROUTES FOR SPENT NUCLEAR FUEL SHIPMENT

Figure 6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Senator HECHT. If you were managing an actual repository, would you prefer to have your facilities and employees handle 10 year old waste, or 50 year old waste?

Mr. VIETH. From a point of view of operations, whether or not the waste is 50 years old or 10 years old, it is certainly still going to be very radioactive and is going to be a risk to the people. You still have to take strong precautions. The radiation levels will be down certainly by a significant factor by the time it is 50 years of age. So the magnitude of potential exposure has gone down on a statistical basis. It is likely that the collective exposure from 50 year old waste might not be as great as it is for 10. Under either condition, the employees that will be working under those conditions will be safe.

Senator HECHT. I know time is a problem so I will stop for the moment.

The CHAIRMAN. Thank you, Senator. Senator Evans.

Senator EVANS. Thank you, Mr. Chairman. I will try to be brief because this is not my State, but there are some very interesting facts here. You mentioned a 57 kilowatts per acre heat load I think was the term you used. That is the design parameter for the kind of material that you are dealing with, and that is the heat load, and the 1,500 acres required for 70,000 tons is based on 10 year old material?

Mr. VIETH. Yes, sir.

Senator EVANS. For Hanford, is it the same parameter, 57 kilowatts per acre?

Mr. ANTTONEN. I believe it is, but I would have to go back and check. Also we are looking at the underground facility, roughly about 2,000 acres for 70,000 metric tons facility.

Senator EVANS. Let us just take Nevada for now, 57 kilowatts per acre heat load. That is a fixed figure, so that adds up as I can calculate it to about 1.2 kilowatts per ton?

Mr. VIETH. That is correct.

Senator EVANS. If it is 1.2 kilowatts per ton at 10 years old, do you have any idea how many kilowatts per ton the heat load is at 50 years?

Mr. VIETH. I would say it is in the neighborhood, and this is a rough estimate, of about 0.4 kW per metric ton.

Senator EVANS. Is this a linear kind of thing so that if that 0.4 is one-third of the 1.2, does that mean you can put three times as much material in the same acre?

Mr. VIETH. No, it does not. By the time you get down to 50 years, it is not on linear. It is an exponential decay.

Senator EVANS. I know it is an exponential decay, but at that point you are down to four-tenths, and you said you could load it up to this 1.2 or the 57 kilowatts per acre.

Mr. VIETH. If you go out to 100 years, it is about two-tenths of a kilowatt per metric ton.

Senator EVANS. But you are saying the number of tons per acre that you can put into a repository is limited by the heat load. You do not want to go beyond that 57 kilowatts per acre presumably.

Mr. VIETH. That is right, assuming 10 year old fuel.

Senator EVANS. If 10 year old fuel is producing——

Mr. VIETH. It is not an easy computation.

Senator EVANS. I am very much aware that it is an exponential curve in terms of the cooling. What I am trying to get at is how much more fuel you can load into that acreage if you used 50-year-old fuel rather than 10-year-old fuel. If 50-year-old fuel at that point gives off just four-tenths of a kilowatt per ton compared to 1.2 kilowats per ton in 10-year-old fuel, doesn't that indicate that if you put three times as much of the older fuel in that acre it would, at that point, still give off only 57 kilowatts of heat?

Mr. VIETH. I am not following the logic of that. Basically if you were dropping it down from 1.2—I see, a factor of three?

Senator EVANS. Yes. Could you not put three times as much fuel in the same acre?

Mr. VIETH. Not exactly, mainly because you have to take into account that early exponential decay. You might be able to put maybe one and a half times.

Senator EVANS. I guess I do not see why. Maybe instead of extending this, you can give me a short physics lesson by letter or something. It seems to me that if 50 years has gone by someplace on the surface, that that would no longer be a factor for deep geologic storage. Obviously the only thing you have to characterize and the only thing you have to worry about is the heat produced from the moment you put it in the repository forward. You do not care what has happened in the past, do you?

Mr. VIETH. As long as that past has not taken place inside the geology, no.

Senator EVANS. That is what I am saying. I am talking about the difference. Your design is assuming that the fuel is 10 years old, and you said and I think logically that some of the fuel is a lot older than that now. But the design factor on which all of the cost calculations have been made and on the 70,000 ton limit, and a whole lot of other things that have been done were all made from that basic design parameter.

I guess what I am saying is at the time the fuel is placed in the repository—if the design parameter were based on 50 year old fuel rather than 10-year-old fuel, at least roughly, that would indicate, if your figures are right on the four-tenths kilowatt per ton at 50 years, that you could pack it about three times more densely and still not end up with anymore heat load from that moment on?

Mr. VIETH. And the point that I am trying to make is you are looking at what you believe may be a linear relationship. The point is you have to look at the area under the curve to get an integrated value, and I think that is where the difference is between whether or not you think it should be a factor of three, or what I would say is closer to one and a half.

Senator EVANS. I don't know. The integrated value in looking at that curve, understanding that curve, it would seem to me it would be the other way. Rather than three, it might be more rather than less because you have taken up a substantial amount of that area of total heat in the first 40 years. You have a lot less heat left to go.

If you could, for the record, a little more accurately answer this question, because we have danced around this and we have not had anything other than just general kinds of response from the Department in any previous testimony—The response from Mr.

Rusche was that it might cut the cost of a deep repository by something between a billion and a billion and a half dollars, which is worth taking a look at. I am more interested in what effect 50 year old fuel rather than 10 year old fuel would do to the density with which you could store the material.

Mr. VIETH. I think we can handle that.

[The information follows:]

CALCULATION OF THERMAL POWER DENSITY EMPLACEMENT OF SPENT FUEL IN A REPOSITORY

BACKGROUND

This material is presented to clarify the position presented to Senator Evans at the June 29, 1987, hearing on the repository projects. At that time, the data discussed were those presented in a 1981 publication entitled "Monitored Retrievable Storage Concept - A Review of its Status, and Analysis of its Impact on the Waste Management System." The reference data included indicated that the heat generating capacity of spent fuel was 1.2 KW/MTHM at 10 years out of the reactor. Mr. Evans asked for an estimate of what the power level would be at 50 years out of the reactor and Dr. Vieth estimated about 0.4 KW/MTHM. Mr. Evans postulated that if we waited another 40 years, then we should be able to increase the emplacement density of spent fuel in the repository by a factor of three. Dr. Vieth indicated that the emplacement density of spent fuel in the repository was not a linear function of spent fuel heat generating capability, and that other factors were important. The following discussion is an attempt to explain the basis for such a determination, and to explain the impact of letting spent fuel cool another 40 years before emplacing it in a repository.

CALCULATIONS

The basic factor that affects the emplacement density is not so much that rate of heat input, but the total thermal energy input to formation over a giving period. For a tuff repository, Sandia Laboratories established a 2000-year period as the base period for establishing the design configuration of the repository when considering spent fuel.

Using the base figures for fuel out of reactor for 10 years, which generates heat at 1.05 KW/MTHM, this is an average for all fuel elements considering ones from both boiling water reactors and pressurized water reactors. With a thermal power density of 54 KW/acre, the total heat energy input to the repository is 8975 KW-years/acre.

Assuming that the exact same fuel is held for 50 years, and subsequently generates heat at 0.49 KW/MTHM, is placed in the repository with the exact same spatial configuration as for the 10-year fuel, the thermal power density at emplacement would be 25 KW/acre. Over the 2000-year period, the thermal energy input to the repository would be 7550 KW-years/acre.

It should be noted that, while the heat energy proportion rate dropped by a factor of 50 percent from the 10-year old fuel to the 50-year old fuel, the total energy input to the formation only dropped by 20 percent. It is the total heat input that is the critical factor; however, for the purposes of describing a repository, the term of thermal power per acre is a more useful term. Unfortunately, this usage often leads to an inappropriate conclusion as to a repository's capacity, since it does not facilitate the evaluation of the total heat input. If the 50-year old fuel is reconfigured so that the total thermal power input is 8975 KW-year/acre over 2000 years, the thermal power density would be 30 KW/acre.

The reference design case for a repository in tuff assumed that defense high-level waste would be included as well as some West Valley Commercial waste and spent fuel. The amount of spent fuel in the repository is estiamted at 62,000 MTHM. In this repository configuration, assuming 10-year fuel, the 62,000 tons would require 1220 acres. If the fuel was held for 50 years and emplaced at the 30 KW/acre, the area in the repository for the 62,000 tons would be 1025 acres. By holding the fuel for 50 years, there would be a savings of approximately 20 percent on repository area.

Senator EVANS. Just one other question. I know that you all have to operate on the basis of the law as it was written and the regulations which have flowed from that law, and the requirements which we have laid on you for the selecting of sites and narrowing it down to three for the characterization, and now the simultaneous characterization of three sites.

Do you think that a corporation interested in accomplishing the same task would approach it in the same way?

Mr. VIETH. I have a very hard time trying to judge that since I have spent most of my career in the Federal Government, and I am really not familiar with how a private corporation would approach this particular problem.

Senator EVANS. Would it not make sense—I would guess from some knowledge of how mining and oil exploration operations go, recognizing that they have a small chance of successful effort—Most oil drilling wells are dry holes, and most mining is unsuccessful.

Mr. VIETH. Well——

Senator EVANS. It seems to me that the way they approach it is to focus first on those items which are most likely to disqualify the site and successively go through that step by step rather than doing a whole comprehensive program that contemplates spending a whole billion dollars per site before a final decision is made.

Mr. VIETH. Let me try to clarify two points that trigger my thought process. First of all, you are looking at a private corporation that is interested in a profit motive, and they are trying to utilize the earth to gain a benefit. We are looking for something entirely different, even though we are looking at sort of a similiar process because we are concerned about protecting the health and safety of the public.

So the factors that are really important for making that decision, whether or not your private corporation or government trying to protect people, are entirely different. How you would approach the problem might be significantly different because your end motives are different.

Senator EVANS. I based my question on the corporation attempting to accomplish the same end purpose which is the safety—you know, all of the same goals.

Mr. VIETH. But that was going to take me to my second point. The question about focusing on the things that could be—those items that would cause us to reject a site, I think those are the things that we have tried to focus on. As I can remember the guidance has always been turn over the big rocks first and make sure there is nothing that is obvious having to do with the disqualification of the site. I think that that has been consistently the method that we have use in this particular program.

Senator EVANS. What are the two things most likely at the Nevada site, or the three things that successively you think are the most likely early disqualifiers?

Mr. VIETH. I think the early disqualifier was the hydrology, and the second one was the tectonics.

Senator EVANS. Essentially the same as at the Hanford site?

Mr. VIETH. Yes. I think the decision that was made in 1982 by which we picked the unsaturated zone over the saturated zone was specifically to deal with this factor. We wanted to find a way to minimize the situation with regard to the contact with water and its availability to move radioactive waste away.

The second one is in terms of trying to understand that tectonic environment, and that is not an easy one to fully understand if you have to anticipate that you will go into a regulatory review that is going to be suspicious, contentious, and thorough.

Senator EVANS. Does that suggest that you want to assemble all of the information both public and proprietary and put it all essentially on one map or overlays to really determine all of the material that is available as it relates to tectonics?

Mr. VIETH. I think that that is exactly the course of action that has been described, and that map is a little bit more complicated than you might imagine, and where we are right now is preparing that map, and it is called the Site Characterization Plan. It does two things. It tells you everything that we know about the site and, two, what are the remaining issues that have to be resolved and how we are going to go about it. For our particular site that represents about 7,000 pages of document.

The course that you are proposing is in fact the one that has been followed in doing this, and it has been done very sequentially in terms of having an identification of potentially acceptable sites, preparation of the environmental assessment, and now the Site Characterization Plan. The Nuclear Waste Policy Act laid it out very clearly.

Senator EVANS. Mr. Anttonen, that is essentially the same process at Hanford?

Mr. ANTTONEN. Yes, that is correct.

Senator EVANS. Have you utilized all available information on tectonics, or on the seismic nature of that area that is potentially available?

Mr. ANTTONEN. Yes, that is correct. Like Don indicated, we are going through the same process as the other two projects. As part of the site characterization plan the first thing is to identify all the information that you know on the site, and then to establish a program to——

Senator EVANS. Does that include all proprietary information which may be not in the public sphere, but have been made on that site?

Mr. ANTTONEN. We have been receiving a lot of proprietary information and have been working with the people to get their approval to use that information in our program.

Senator EVANS. That is not quite the answer to the question. I asked if you have available all information, or is there some proprietary information which you have not received, or not made available to you?

Mr. ANTTONEN. I believe that we have all the information available.

Senator EVANS. Thank you.

The CHAIRMAN. Mr. Neff.

I think it would be best if you would summarize briefly.

STATEMENT OF J.O. NEFF, MANAGER, SALT REPOSITORY PROJECT OFFICE, DEPARTMENT OF ENERGY

Mr. NEFF. In deference to the hour and to your desire, I guess the one thing that I would like to verbalize from my testimony is related to the issue of payments equivalent to taxes in the area. I think Mr. Rusche has testified in front of this committee about the problems with the current language which really calls into existence those payments for units of general local government.

For the project that I have the responsibility for in Texas, because of the way we are forced to interpret that language which has, my lawyers tell me, a lot of history behind it, i.e., unit of general local government, we find ourselves unable to make payments to special districts in the State of Texas which provide some very essential services which are provided by units of general local government in other states. I believe it is an inequity that I feel very much concerned about, and I think Mr. Ruche has indicated to the committee that we feel a need for some authority to be given there to allow us to move beyond the NWPA.

I just want to bring up to your personal attention, sir, that issue. It is one that we are struggling with in the local area because, as you are aware, payments equivalent to taxes was one mechanism to make this project somewhat acceptable in terms of the local community by making it be able to be taxed as if it were a business.

The CHAIRMAN. I am familiar with those units of local government and their question, and I hope that we can change that at the same time we pass an incentive package, and the bill which we have introduced would provide up to $100 million a year for repository. We can correct that units of local government language at the same time.

[The prepared statement of Mr. Neff follows:]

STATEMENT OF

J. O. NEFF, MANAGER
U.S. DEPARTMENT OF ENERGY SALT REPOSITORY PROJECT OFFICE
BEFORE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

June 29, 1987

Mr. Chairman and Members of the Committee:

My name is Jeff Neff and I am the Manager of the U.S. Department of Energy's Salt Repository Project Office, now located in Hereford, Texas. The responsibilities of my office are to manage the day-to-day activities of the site suitability investigations of the designated nine-square-mile site located in Deaf Smith County, near Hereford in the Texas Panhandle. The location is indicated on several of the attachments.

My remarks will be divided into five categories: (1) a brief history of how the Deaf Smith County site was designated; (2) a review of major issues for the Texas site and how these are expected to be resolved during site characterization; (3) a summary of major institutional issues; (4) a summary of consultation and cooperation activities with the State of Texas, through its Nuclear Waste Programs Office; and (5) highlights of current and past interactions with local governmental officials and the public in the Panhandle.

History of Salt Site Activities

The process that led us to the site in bedded salt in Deaf Smith County, Texas, began in 1957, when a panel of the National Academy of Sciences recommended salt formations in the United States be studied for potential underground sites for permanent disposal of high-level radioactive waste. The U.S. Geological Survey launched national screening studies the following year.

In 1976, the Survey identified two bedded salt areas in the Texas Panhandle for further study--the 18-county Palo Duro basin south of Amarillo, and the 5-county Dalhart basin north of Amarillo.

Other salt deposits identified by USGS in the national screening process for further study included bedded formations in the Paradox Basin of Utah and Colorado; the Salina Basin in Michigan, New York and Ohio; and salt domes in Louisiana, Mississippi and eastern Texas. (See Attachment A.)

Within those regions, DOE then moved, step-by-step, to identify smaller areas for more intensive study, evaluating thickness and depth of salt, the presence of faults, seismicity and salt dissolution. Also considered were such factors as the existence of other natural resources such as oil and gas, land uses, and density and distribution of population. (See Attachment B.)

Directed by the Nuclear Waste Policy Act of 1982 (NWPA) to select potentially acceptable geologic sites for a repository, the DOE selected nine possible sites in six states. Two of the sites were located in bedded salt in the Texas panhandle--300 square miles in Deaf Smith and Oldham counties and 190 square miles in Swisher County.

Each of the two Texas sites later was narrowed to nine square miles for the environmental assessment process required by the NWPA.

In May 1986, three of the nine sites evaluated in the environmental assessments were recommended to and approved by the President for characterization. The salt site selected for further study is in Deaf Smith County, 40 miles southwest of Amarillo. (See Attachment C.) Documents describing this process are listed on Attachment D.

Major Issues at the Deaf Smith County Site

The next step in the process is to conduct site characterization at each of three sites, including the site in Deaf Smith County, Texas. The site characterization phase was conceived and placed in the NWPA by Congress specifically to obtain data of the surface and at the depth where the repository would be constructed to determine the site's suitability. This next step is designed to address the many issues and questions which your constituents and all of us in the program need to have answered before a site is recommended for the geologic repository. The U.S. Nuclear Regulatory Commission, and state and local groups will review and monitor plans and results.

These issues remain to be resolved at the Deaf Smith County as well as at the other two sites. Methods to resolve these issues are being incorporated in the Site Characterization Plan, Environmental-Regulatory Compliance Plan, and the more than 50 detailed site study plans, which spell out the specific work in geotechnical, environmental, and socioeconomic areas.

Attachment E indicates many of the planned activities. There are four major concerns that I would like to discuss today: the potential for contamination or depletion of the Ogallala and Dockum aquifers; management of excavated salt; effects on the agricultural economy and public perceptions of how studies will affect agribusiness; and general socioeconomic impacts.

- The potential for contaminating or depleting the Ogallala and Dockum (Santa Rosa) Aquifers

First, some general information about project design. The repository system itself is being designed and would be operated to prevent contamination of surface water or ground water. Waste brought to a repository would be in solid form and in heavily shielded casks. Waste packages would be emplaced 2,500 feet below the surface in a stable salt formation.

The rock strength and very low permeability of this formation will be verified during the first seven years of site characterization. Multiple barriers will contain the waste's movement. Engineered barriers--including an insoluble waste form, a corrosion-resistant metal container, repository backfill material, and shaft seals--will be added to the natural barriers of the rock at extreme depth.

The Dockum aquifer is more than 1,000 feet above the proposed depth of a repository; the Ogallala aquifer is approximately 2,000 feet above the proposed repository. In general, our analyses show that the pressure for the aquifers in the vicinity of the Texas site decreases with depth. This creates the potential for groundwater at repository depth to flow down to the deeper saline aquifers rather than upward toward the Ogallala and Santa Rosa aquifers.

The concern is that the Ogallala and Dockum aquifers could be contaminated during construction of shafts for site characterization. This will be avoided through use of a proven (over 100 years old) ground freezing technique which is widely employed for digging tunnels and mine shafts where water is anticipated. For example, shafts for mines in Saskatchewan, Canada, have successfully penetrated major aquifers with ground freezing during shaft construction. This method is being used successfully at the repository being constructed in the Federal Republic of Germany at Gorleben.

As a part of shaft construction, seals and plugs will be placed at required intervals to prevent water from moving down the shaft as well as to protect water quality. Throughout the construction and operation process of the exploratory shaft facility and the repository, DOE will continuously monitor the shafts for stability and performance of the lining and seals.

Water requirements for a repository in the Texas Panhandle, averaging the amounts to be required for construction and waste emplacement, are expected to be approximately 443 acre-feet per year. This may be reduced by recycling the water. This is equivalent to the amount of water needed to irrigate from 265 to 400 acres.

o How excavated salt at the Deaf Smith County site will be managed

Assuring that excavated salt does not contaminate water or soil is an important consideration in DOE's program. Salt management procedures during the construction of an exploratory shaft for site characterization and the repository will be similar to those commonly used in the mining industry. The amount of salt excavated for site characterization will be far less than the amount excavated for the repository. A combination of water spraying (resulting in the salt crusting over), retention ponds, impermeable liners, runoff control structures and monitoring of soil and crop conditions are proven techniques for effectively reducing the possibility of soil or water contamination from the excavated or blowing salt.

During site characterization, shallow boreholes and wells will be drilled to study rock characteristics and groundwater. Any salt-contaminated fluid produced during drilling will be stored temporarily in tanks or lined mud pits until it can be disposed of off site.

Two exploratory shafts to conduct more detailed studies at depth will also be constructed. Prior to the mining of salt and any storage on the surface, DOE plans to conduct laboratory-scale experiments on wind dispersal of salt and on dust formation. These data will be evaluated against actual salt pile experience at several locations in the country and against actual site meteorological data. Based on these evaluations, a decision will be made whether to store the salt on site, either covered or uncovered, or to ship it off site. If the excavated salt is stored temporarily on the surface, it would be in a pile less than 50 feet high, covering less than 5 acres, and containing about 140,000 tons of salt. Most of the salt would be used for backfill if the site is not selected for a repository.

Throughout construction and operation of the exploratory shaft facility and the repository, salt management techniques will be monitored. For example, air quality stations will be established and groundwater downstream from the salt pile will be monitored. We foresee that neighboring farmers will aid in the monitoring through review and comment on our plans and suggestions for placement of air sampling monitoring stations. Any effects of wind-blown salt will be apparent on plants within the site prior to possible effects outside the site. The appropriate correction or remedial will be taken immediately if effects are seen.

- The effects on the agricultural economy of the area, including the public's perception of a repository

We believe that how well this project is perceived will depend on how well it is operated. DOE intends to construct and operate the exploratory shaft facility and repository according to the best standards of industrial and scientific practice, under continuous scrutiny by federal agencies such as the Nuclear Regulatory Commission, the Mine Safety and Health Administration, the Environmental Protection Agency, the State, and local and scientific groups, including the National Academy of Sciences.

While a high-level nuclear waste repository has not yet been constructed, the technology for operating a repository is based on well-known principles and has been demonstrated successfully in Nevada (the Nevada Nuclear Waste Storage Investigations project) and in the Federal Republic of Germany (programs of the Physikalisch-Technische Bundesanstalt, PTB). A demonstration project is also planned at the Waste Isolation Pilot Project in Carlsbad, New Mexico.

There are two parts to the agricultural issue: land use and the possible effect a repository would have on sales of agricultural products, e.g., the "perception" issue.

The 5,760-acre site in Deaf Smith County includes 5,168 acres of cropland. A major part of the surface acreage will remain in agricultural use during site characterization activities because only about 61 acres will be required for the exploratory shaft facilities. Approximately 600 acres, including the 61 acres, will have limited access because of the many activities to be conducted there. Access to additional parcels will be necessary for specific geologic and environmental activities, but most of these will be small plots, the need of limited duration, and the placement and timing flexible. DOE will also need to protect the nine-square-mile site for a repository by prohibiting or regulating deep drilling and certain other subsurface activities. This will be accomplished by entering into agreements with affected landowners to regulate these activities. Landowners will be compensated for all land uses.

If the Deaf Smith County site is selected for a repository, from 400 to 700 acres will be required for the surface facilities. Agricultural activities may be possible on surface acreage outside the 400 to 700 acres of working facilities, subject to restrictions by the Nuclear Regulatory Commission. In total, an estimated 5,836 acres (0.61 percent of the total productive land in Deaf Smith County) could be affected if a repository is constructed. Estimated losses to cattle and livestock production in Deaf Smith County would be approximately $1.5 million per year as a direct effect of repository construction.

Regarding the perception issue, we have sought information from comparable experiences to help us understand the potential effects of locating such a facility near agricultural areas. At the Three Mile Island nuclear power plant, after the accident that certainly had high national visibility, a study by the state health department indicated there were no sustained effects on the area's agricultural image. Sales of agricultural products were affected for only about one week following the accident. Agribusinesses are conducted adjacent to many nuclear facilities without apparent effects on sales of products. Admittedly, building a repository is a unique step and we intend to continue studying this issue during the five to seven years of site characterization.

- Socioeconomic impacts of the project on communities

On April 22, 1987, DOE provided an estimate to the Texas Advisory Council on Intergovernmental Relations that 3,215 people, including workers' families, will move to the Panhandle during the five to seven years of site characterization studies in Deaf Smith County. An estimated 2,283 would locate in Amarillo, 402 in Hereford, 432 in Canyon, 28 in Vega, and 18 in rural areas. Of these people, 1,088 are project workers.

During site characterization, we estimate that approximately $475 million will be spent on materials and labor, including many purchases in the local area. Later I will describe our attempts to maximize the awarding of contracts to local companies and the hiring of local workers, within federal procurement regulations.

The Deaf Smith County Environmental Assessment estimated peak migration to the area would be 2,520 workers during repository construction and 2,040 workers during repository operation.

The Environmental Assessment estimated that direct purchases of materials during repository construction will be $11.3 million per year (1983 dollars), of which 10 percent are expected to be made in the local area. During operation, direct local purchases are estimated to average about $3 million per year.

Additional funding will be made available to local taxing districts during site characterization and during repository construction and operation in the form of payments-equal-to-taxes, as explained in more detail later. Currently, funds are provided through grants to the Texas Nuclear Waste Programs Office and local groups such as the Deaf Smith County Waste Deposit Impact Committee for review and oversight purposes.

Status of Other Site Activities

Several other activities are also important in regard to the Deaf Smith County site. These include issues related to impact mitigation during site characterization and payments-equal-to-taxes, relocation of staff to the Panhandle, special needs of landowners, and the ability of local businesses and people to obtain contracts and jobs. I would like to address each issue in detail.

o Grant funds for impact mitigation during site characterization are not provided for by the Nuclear Waste Policy Act. This has caused concern among Texas communities near the site in Deaf Smith County, because some local leaders fear that this project is already causing significant impacts. They believe that DOE should be prepared to mitigate impacts as they occur. DOE believes, as stated in the environmental assessment, that site characterization will not have significant adverse impacts. To the extent practicable, we are required by the Act to conduct activities in a manner that minimizes any significant adverse impacts. We plan to monitor all activities and to mitigate any tangible demonstrated effects.

We have been in regular communication with local leaders, exchanging information about the project's effects on the schools, services, and so forth as part of that monitoring process. In addition, we have investigated and provided to them information on other federal funding sources, worked through the Texas Nuclear Waste Programs Office to approve grant funds to help communities study the program and prepare to assess impacts, and tracked staff plans for locating in communities in the Panhandle to anticipate immigration effects.

o The Nuclear Waste Policy Act does require DOE to provide payments-equal-to-taxes during site characterization. These payments can be used by an eligible state, unit of general local government, or affected Indian Tribe (in accordance with applicable state and local laws) for various purposes, including mitigating impacts that may occur as a result of site characterization. Such payments would be comparable to those a private business would normally pay in taxes on similar work. DOE's policy is that such payments will be retroactive to May 28, 1986, when sites were designated for characterization.

As Mr. Rusche previously has brought to your attention, the Act provides that payments can be made only to units of general local government, defined as a general purpose political subdivision of a state. The Vega Independent School District is a special district and thus the Department reluctantly concluded that the District is not an eligible jurisdiction. This issue pertains to all special taxation districts in Texas. As Mr. Rusche has stated, DOE does not believe this to be the intent of the NWPA, but we are constrained by the law. On the PETT issue as well as the grant issue, we need legislative authority to resolve this issue successfully.

- Representatives of the state and several communities believe that they have already been impacted by transition of project staff to the Panhandle. The Salt Repository Project Office is following a phased relocation plan to gradually relocate project staff to the Panhandle. The process began with 11 people moving in March and is designed to move people concurrent with when their work can better be accomplished in the area than from Columbus, Ohio. Currently, about 70 DOE and contractor staff are located in the Panhandle. Approximately 70 additional staff members will relocate this summer.

By fall, we expect the project workforce in Hereford to reach approximately 300. The relocation was phased to avoid adverse impacts to the project as well as the communities, including surges of in-migration, undue interruptions of technical work, and personal relocation needs.

- Land acquisition and access issues are of critical concern to landowners within and near the nine-square-mile site in Deaf Smith County. We are attempting to interact with landowners and operators with utmost sensitivity to their feelings and interests. We met with landowners in Vega on February 23, 1987, to provide information on upcoming site characterization activities and listen to their suggestions. We are now awaiting the Real Estate Planning Report from the U.S. Army Corps of Engineers, which will describe the lands needed and recommend the property interests that should be acquired. This report will be ready this summer and relevant portions will be sent to the state and all landowners. We will then meet with landowners to discuss land acquisition plans. Through this process we hope to be active in negotiations this fall.

o Several local officials have stressed that, wherever possible, the Salt Repository Project should benefit local communities. We have made this our goal.

DOE demonstrated its intent to bring positive benefits to affected communities by choosing to locate our offices in Hereford, as well as the office of the project's integrating contractor (Battelle Memorial Institute) and exploratory shaft construction management contractor (Parsons-Redpath). We are also attempting to make as many purchases as possible in Hereford, subject to technical requirements and federal procurement regulations.

Since the beginning of relocation in March, the Salt Repository Project has spent more than $1 million in the Panhandle for supplies, office equipment, and materials. Nearly 40 area people have been hired in professional and secretarial categories.

We are working with business leaders in Hereford to develop a workshop for local suppliers and contractors to explain federal procurement procedures and assist them in learning how to expand business opportunities and bid for contracts. In addition, we have made mailings to people who have expressed an interest in job opportunities, explaining the process for federal and contractor jobs. And we are posting job opportunities with the Texas Employment Commission offices as well as advertising them in newspapers throughout the Panhandle.

Consultation and Cooperation with the State of Texas

Throughout nine years as manager of DOE's salt repository studies, I have worked frequently and closely with state officials and agencies in Texas. So I can attest personally to the high quality and productivity of interactions with Governors Clements and White, their representatives and committees, and other officials and offices in a state government that I have come to know and respect as extremely competent, professional--and, yes, complex.

The record shows, in fact, that from the beginning, the state of Texas has taken an active and valuable role as a key state in the repository siting process. The Bureau of Economic Geology at the University of Texas at Austin performed early evaluations of the suitability of East Texas salt domes (which were dropped from consideration in 1980) and for more than 10 years has worked under contract with my office and with other contractors in Panhandle field studies. Written interim agreements dating to 1980 have guided consultation and cooperation with the Bureau of Economic Geology and other Texas agencies. Texas representatives have been included in hundreds of technical and institutional meetings and workshops.

In short, be assured that the official voice of the state of Texas in this program has been heard--long, loud and clear--and in a variety of settings and channels of communication: comments on many technical documents, frequent written and oral comunication, extensive testimony in pre-site nomination scoping hearings, draft guidelines hearings, and meetings and hearings on draft environmental assessments of the potentially acceptable repository sites.

Since the designation of a Texas site for characterization 13 months ago, areas of interactive activity which no doubt interest members of this committee include preliminary steps to negotiate a consultation and cooperation agreement, state participation in planning and policy development, and the sharing of information.

o C&C Agreement--In a letter July 1986, to the director of the Texas Nuclear Waste Programs Office, I invited the state to meet with DOE and representatives of Nevada and Washington to initiate the process of developing consultation and cooperation agreements as provided by the Nuclear Waste Policy Act. In response to a subsequent expression that Texas preferred individual involvement in such negotiations, in November 1986 I renewed DOE's offer to negotiate an agreement, this time directly with the state. In several informal discussions since then, the Texas Nuclear Waste Programs Office director has indicated that Texas is not yet prepared to undertake negotiations to attain formal agreement.

- Salt State Meetings--After seven salt sites in four states were selected in 1983 as potentially acceptable for characterization, my office met with representatives from Texas and other affected states in a series of bi-monthly meetings held from July 1983 through November 1984. These meetings provided interactive information exchange on institutional and technical issues.

Such regular, detailed sessions laid much of the foundation, I believe, for accelerated involvement of Texas and other states in a variety of positive and productive interactions to plan site characterization.

Texas representatives currently are fully involved in 14 program working groups, e.g., DOE's Environmental, Transportation, Quality Assurance and Institutional/Socioeconomic Coordinating Groups, as well as in development of the highly technical Deaf Smith County Site Characterization Plan and a local public participation plan.

- Information--To facilitate effective state involvement in site characterization, SRP has met or talked with Texas officials several dozen times in the past year on a wide range of subjects. They include site transition planning, land access and the DOE-U.S. Army Corps of Engineers agreement, plans for public information and briefings, plans for early site studies, annotated table of contents and draft chapters of the Site Characterization Plan, site study plans, the Environmental-Regulatory Compliance Plan, environmental and socioeconomic monitoring and mitigation plans, and applications of the payments-equal-to-taxes provisions of the NWPA.

- Texas Grant Status--The Texas Nuclear Waste Programs Office applied to DOE for a grant of $6.7 million for the 1987 fiscal year. In December 1986, we approved an initial amount of $2.5 million following an analysis of the state's request. We asked for additional information to better understand the scope of work for the remaining amount.

We have now received this additional information and expect to release additional grant funds soon. DOE has instituted new procedures to expedite processing and approving state and tribal grant requests.

In addition, at the Salt Repository Project Office we are placing more emphasis on reviewing grants, including the addition of a new staff member to expedite the project office's process.

Local and Public Interactions

Since early March, when we began relocating staff to the Texas Panhandle, we have attempted to increase interactions with and personal response to affected parties. These have included:

- Bi-weekly status reports to local offices of area Congressional representatives.
- Weekly meetings at the Community Center in Hereford, where my Deputy Manager provides status reports on relocation of staff, hiring, field activities, office procurements, and other ongoing activities.
- Communications with landowners, including the February meeting, mailing of revised land acquisition schedule

in May, and plans for a meeting to be held by DOE for landowners this fall to discuss the DOE Land Acquisition Plan.

- Daily verbal or written response to people interested in jobs or contracts on the project.
- Weekly discussions with the executive director of the Deaf Smith County Waste Deposit Impact Committee, based in Hereford.
- Appearances before the Deaf Smith County Commissioners.
- Discussions with Vega Independent School Board officials about possible impact mitigation funds.
- Three briefings for staff of the City of Amarillo in June.
- Regular access to news media representatives for program updates and in-depth articles about transition and study plans.
- Hired nearly 40 local people in professional and secretarial positions.
- Speakers' bureau presentations--an average of about 20 per month--where members of my staff and contractor personnel fill requests from community groups, schools, and technical organizations throughout the Panhandle to provide information about this program.
- Program exhibits at technical group meetings, library association conventions, and area career days.
- Planning with local leaders for workshops for local business on purchasing and contracting opportunities.

- Finalized local procurements for leasing office space in Hereford, as well as equipment and furniture for DOE and contractor staff.
- Teacher workshop being planned, coordinated with the regional office of the state education agency.
- Plans to open a public information office in Amarillo, similar to those in Hereford, Vega, and Tulia.
- Presentations by Panhandle academicians to staff in Columbus planning to relocate, to inform them about the culture, history, and economic background of the area.

Prior to beginning relocation of offices to the Panhandle, the week of February 23, 1987, we conducted briefings for landowners, local officials, and the public to provide information on the activities and schedule for work connected with site characterization. People in Hereford, Amarillo, and Vega had opportunities to hear brief presentations about activities, ask questions or make suggestions to us and then to interact personally with more than 40 technical staff who are planning the work.

The Salt Repository Project Office has also taken the first steps on the road to developing a public participation plan, which is designed to assure that the project's technical work scope is fulfilled while the concerns of local citizens are addressed. As you know, the need to involve the public in order to build confidence in the disposal process is one of the seven findings of the Nuclear Waste Policy Act. DOE's further commitment to public participation is described in several guidance documents as well as the Mission Plan. In the Salt

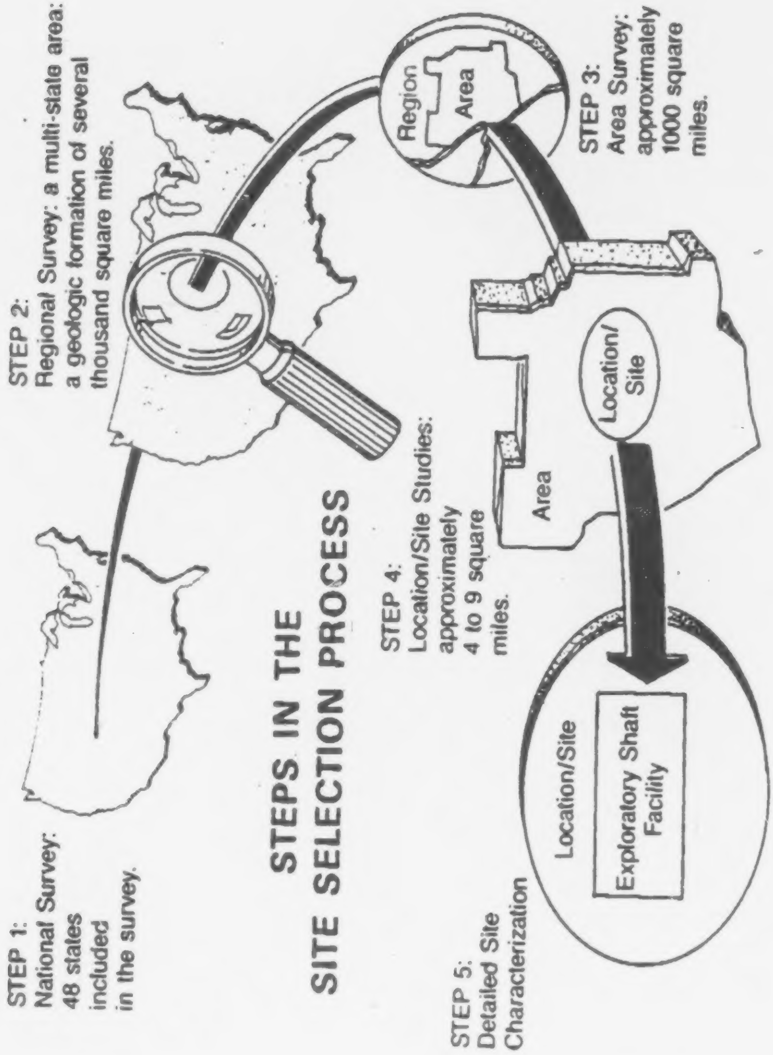
Repository Project Office, we have contracted with a private consultant to follow a three-step process to develop a public participation plan. The process shows people how to develop a schedule of activities on which they want to provide input and establishes methods for them to have affect on study planning, data evaluation, and decision-making.

After more than three years of preparation, we started the public participation planning process in early May by holding working sessions in Hereford and Amarillo to explain the process.

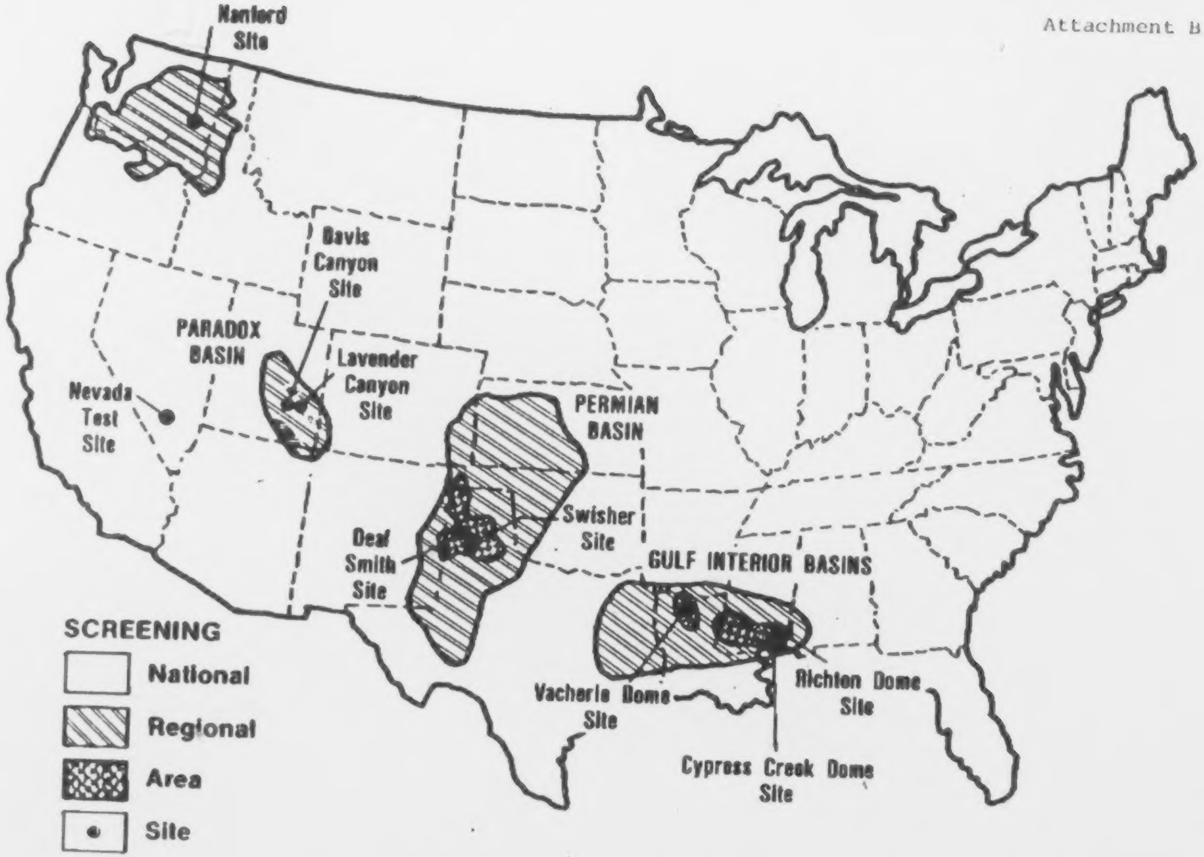
Our consultant is now working with project technical staff on ways the public can be involved effectively in site study planning. In July and August, we will be talking again with local groups about each community's needs and interests, so we can begin developing the draft plan.

Meanwhile, we are continuing the public outreach activities that have been available to people in Texas for more than five years. These are summarized on Attachment F.

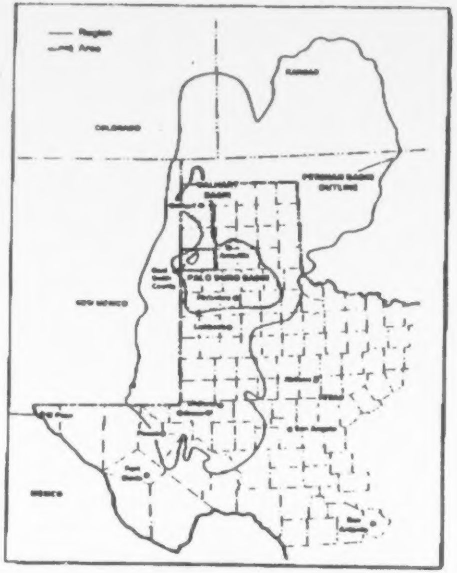
This concludes my statement. I would be happy to answer any questions you may have about the Texas project.


STEPS IN THE SITE SELECTION PROCESS
STEP 1: National Survey: 48 states included in the survey.
STEP 2: Regional Survey: a multi-state area: a geologic formation of several thousand square miles.
STEP 3: Area Survey: approximately 1000 square miles.
Region
Area
STEP 4: Location/Site Studies: approximately 4 to 9 square miles.
Area
Location/Site
STEP 5: Detailed Site Characterization
Location/Site
Exploratory Shaft Facility

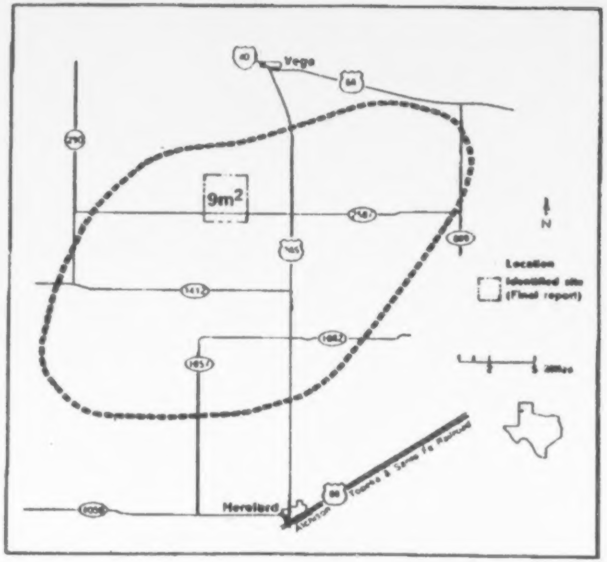
Attachment B


Hanford Site
Davis Canyon Site
PARADOX BASIN
Lavender Canyon Site
Nevada Test Site
PERMIAN BASIN
Swisher Site
Deaf Smith Site
GULF INTERIOR BASINS
Vacherie Dome Site
Richton Dome Site
Cypress Creek Dome Site
SCREENING
National
Regional
Area
Site

Site Exploration Program


Region
Area
COLORADO
KANSAS
NEW MEXICO
MEXICO
PERMIAN BASIN OUTLINE
PALO DURO BASIN

Regional, Area, Location Screening, Permian Basin in Texas


40
Vega
66
9m²
Location
Identified site (Final report)
N
Hereford
66
Atchison Topeka & Santa Fe Railroad

Deaf Smith County Site

Salt Site Exploration Program Documents

Salt national survey report

Salt Deposits in the United States and Regional Geologic Characteristics Important for Storage of Radioactive Waste, by Kenneth S. Johnson and S. Gonzales, Y/ONWI/741/4/1, March 1978.

Describes the national screening of salt deposits in the contiguous United States to identify regions with rock formations with potential for further studies. . . identifies most favorable regions for regional study.

Size of salt regions

Paradox: 12,000 square miles
Permian: 80,000 square miles
Gulf: 60,000 square miles

Size of area (Palo Duro/Dalhart Basins)

14,000 square miles

Size of locations in Panhandle

Deaf Smith—400 square miles
Swisher—200 square miles

Size of site in Deaf Smith County

Deaf Smith County Site—9 square miles

Screening Documents for Texas Panhandle*

Regional:

- *Environmental Characterization of Bedded Salt Formations and Overlying Areas of the Permian Basin*, ONWI-27, 1983.
- *Evaluation of Permian Salt Deposits in the Texas Panhandle and Western Oklahoma for Underground Storage of Radioactive Wastes*, by Kenneth S. Johnson, Y/OWI/SUB-4494/1., April 1976.

Salt Site Exploration Program Documents (Continued)

- *Regional Summary and Recommended Study Areas for the Texas Panhandle Portion of the Permian Basin*, ONWI-28, 1984.

Area:

- *Area Environmental Characterization, Report of the Dalhart and Palo Duro Basins in the Texas Panhandle*, ONWI-102, Volumes 1 and 2, 1983.
- *Area Geologic Characterization Report, Palo Duro and Dalhart Basins, Texas*, ONWI-292, 1983.
- *Permian Basin Location Recommendation Report*, ONWI-288, 1983.

Location/Site:

- *Identification of Sites Within the Palo Duro Basin*, DOE/CH-10(3), 1984.

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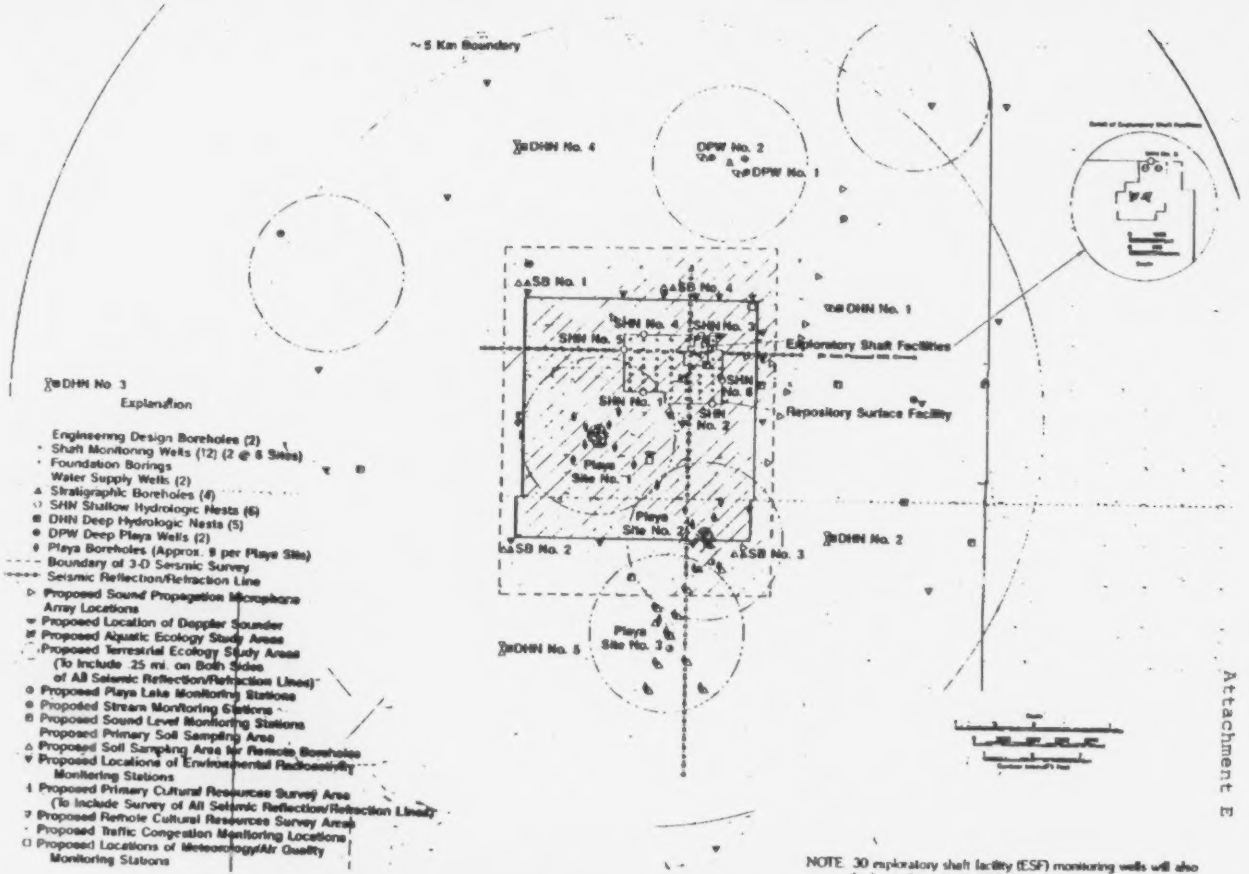
[*] All reports in Panhandle Public Libraries and DOE Information Offices

Attachment E


~5 Km Boundary
DHN No. 4
DPW No. 2
DPW No. 1
DHN No. 3
SB No. 1
SB No. 4
DHN No. 1
SHN No. 4
SHN No. 3
SHN No. 5
Exploratory Shaft Facilities
SHN No. 6
SHN No. 1
SHN No. 2
Repository Surface Facility
Playa Site No. 1
Playa Site No. 2
DHN No. 2
SB No. 2
SB No. 3
Playa Site No. 3
DHN No. 5
Explanation
Engineering Design Boreholes (2)
Shaft Monitoring Wells (12) (2 @ 6 Sites)
Foundation Borings
Water Supply Wells (2)
Stratigraphic Boreholes (4)
SHN Shallow Hydrologic Nests (6)
DHN Deep Hydrologic Nests (5)
DPW Deep Playa Wells (2)
Playa Boreholes (Approx. 9 per Playa Site)
Boundary of 3-D Seismic Survey
Seismic Reflection/Refraction Line
Proposed Sound Propagation Microphone Array Locations
Proposed Location of Doppler Sounder
Proposed Aquatic Ecology Study Areas
Proposed Terrestrial Ecology Study Areas (To Include .25 mi. on Both Sides of All Seismic Reflection/Refraction Lines)
Proposed Playa Lake Monitoring Stations
Proposed Stream Monitoring Stations
Proposed Sound Level Monitoring Stations
Proposed Primary Soil Sampling Area
Proposed Soil Sampling Area for Remote Boreholes
Proposed Locations of Environmental Radioactivity Monitoring Stations
Proposed Primary Cultural Resources Survey Area (To Include Survey of All Seismic Reflection/Refraction Lines)
Proposed Remote Cultural Resources Survey Areas
Proposed Traffic Congestion Monitoring Locations
Proposed Locations of Meteorology/Air Quality Monitoring Stations

NOTE 30 exploratory shaft facility (ESF) monitoring wells will also be located within the ESF boundary

Proposed Location of Field Activities
Deaf Smith County Site

ATTACHMENT F

SALT REPOSITORY PROJECT OUTREACH ACTIVITIES

- Publications and fact sheets about the Salt Repository Project studies as well as the national radioactive waste management program.
- Audiovisual materials and exhibits for use at no cost by schools, groups, conventions, and meetings.
- Public information offices in Hereford, Vega, and Tulia, which provide local people easy access to nontechnical information as well as technical documents and electronic access to data.
- Materials supplied to libraries in the Panhandle, Austin, and major Texas universities.
- Monthly notices to more than 1,000 people on the mailing list of new materials available in information offices and libraries.
- Workshops and field trips upon request (e.g., Waste Isolation Pilot Plant near Carlsbad, New Mexico).
- Bilingual materials--one fact sheet in Spanish, a second to be available this month; a videotape describing program background, to be available this month in English and Spanish.
- Public meetings, briefings, and hearings as appropriate or requested.

The CHAIRMAN. While we are on that subject, I understand there are 2,526 construction jobs and 2,040 regular jobs once this is in operation?

Mr. NEFF. Yes. Those numbers—I do not remember those exact numbers, but they are——

The CHAIRMAN. I think they are in your statement.

Mr. NEFF. For the repository construction, yes, that is correct.

The CHAIRMAN. Two thousand five hundred twenty-six for construction, and then 2,040 for operation?

Mr. NEFF. Yes.

The CHAIRMAN. Those are full-time permanent jobs after you are in operation?

Mr. NEFF. Yes.

The CHAIRMAN. Mr. Neff, you describe in your statement the lengths to which you have gone to cooperate with the Texas people. Has that been a fairly good relationship, or is it a difficult relationship?

Mr. NEFF. I think it has been a very good relationship. I think we understand the political pressures that the State operates under and the immediacy of their advocacy groups that come into them. We have been able to establish areas of discussion with the State, recognize real areas of disagreement and go beyond those to have discussions on other areas where we can have agreement, and where we can basically work together.

So I think it has been a good relationship from my own personal observation.

The CHAIRMAN. Mr. Neff, in your statement you talk about the fact that the Ogallala Aquifer is 2,000 feet above where this would be stored, and another aquifer is 1,000 feet above, and that because of the pressures on the aquifers, the water tends to go down rather than up. You also go into some detail about how in drilling the shaft you would freeze it according to technology 100 years old, and that you would have a high degree of confidence that during that construction process you would not have intrusion of the water into the shaft.

My question is this. Would you not worry about, after the shaft is complete, it is all sealed, or even during operation, that water might get down into the cavity, or is that not a concern?

Mr. NEFF. Yes. I think inevitably it is a concern, although we believe that we will be able to demonstrate that the seals are tight as we are building them. That is a concern, and we would be monitoring the levels of the aquifers by monitoring wells, observing any unexplained lowering of levels, et cetera. We would be monitoring the moisture inside the shafts and around the shafts to determine if we were getting any leakage. That is not an uncommon phenomena, and there is a lot of experience with shaft construction of going back in and stopping those leaks with grouting, et cetera.

So while we believe that during the construction period we will be able to demonstrate the leak tightness, we will maintain through the operation of the repository, which now we are talking about a 50 to a 100 year period, an evaluation program of the leak tightness of those seals.

So that by the time we are prepared to suggest to the NRC that we close the facility up, there will be on the order of 50–100 years of data looking at that particular phenomena.

The CHAIRMAN. Suppose water does leak 100 years later or whenever, and you get the shaft filled with water. Is that a problem? What kind of problem is it?

Mr. NEFF. Our evaluations right now would say that that would not be a problem that would invalidate the repository. We would still have bulkheads in the drifts underground, seals on each of the individual adits that are built underground. In addition, if we are able to confirm this pressure differential that I have quoted as one of the positive features of that basin, then we would not expect an active circulation process in that filled shaft.

Again, a shaft filled with water would be a great concern and would represent another level of evaluation and intensive scrutiny that we would have to go through.

The CHAIRMAN. In Sweden they have one of their, not repositories, but a medium level repository built under the ocean, in rock under the ocean. They have several seals there, but they expect that to be flooded over time. Their statement is that the movement of the water would be so slow and would not be an upward direction, that it is built into this design criteria.

Are you in effect saying that the same phenomena would be true in Deaf Smith, but in addition to that you would seal it off over a period of 100 years so you would have high confidence in the seals. But if the seals did break, the pressure differential would say that water would not move up, it would move down?

Mr. NEFF. The phenomena on the pressure differentials would be the same if that is what it is in Sweden. I should say that we do not expect the salt repository, if it were to be a repository, to fill up with water. One of the reasons for looking at salt beds has been historically because of their isolation from water by the very nature of the dissolution of salt in an active water system.

We are not anticipating an eventual filling of the salt repository with water. If such a thing should occur, I think there are a set of arguments that we could make associated with the pressure differentials, et cetera, which would still lead one to believe that from a public health and safety viewpoint the repository would be acceptable.

I would like to say, sir, that I think that if you take salt now, with its dissolution problem, if we have to contend with a flooded mine, we have gone into another arena of analysis and evaluation, a much more difficult one.

The CHAIRMAN. I understand that the salt would flow actually once you put the waste in the salt, seal it up, it would become molten around the canister and there would be some flow to it?

Mr. NEFF. It does not become molten in the sense that it changes phase. Salt is a plastic media so it deforms under stress over a period of time. As a salt system, as a pure rock, it will flow and close up underground openings. It is one of the advantages of salt in terms of long-term isolation because the tunnels and the drifts, et cetera, would potentially close up. It is a problematic thing relative to the issue of retrievability, which is a requirement that the Nuclear Regulatory Commission has placed upon the Department, in the sense that we will have to reduce heat loads from what the salt would normally be able to take in order to assure that the mine will not be creep closed during the 50 to 100 year period that we have discussed.

The **Chairman**. It is more safe because of the sealing, but retrievability, it makes it more difficult?

Mr. **Neff**. Yes. It brings in the potential of actually having to remine under some retrievability scenarios.

The **Chairman**. And the retrievability would be for reprocessing, or for other reasons?

Mr. **Neff**. The primary purpose, as I understand the Nuclear Regulatory Commission's regulations, was to assure that if you saw something underground that was beginning to invalidate your understanding of the geology and that it was becoming unsafe, that you would be able to go back and get the waste out and place it someplace else.

The **Chairman**. Mr. Neff, the same question I asked to the other witnesses. Do you have a view as to the degree of confidence to which your present theories about the suitability of this site would be validated through characterization?

Mr. **Neff**. Yes. I mean, my view is that by the careful selection of these sites, particularly the salt site where we have gone through a progression of the screening out of areas that might have had potential fatal flaws, I believe that with the Deaf Smith County site we have a site that has a 90 percent chance of going through site characterization, in my view.

Sir, there are many surprises in the earth, but based on my understanding of this system and the predictability of those salt beds, which we will very quickly be getting some correlation for, I think the number is very high. I would hasten to add that does not mean that I would——

The **Chairman**. You are not insuring it. We understand that.

Mr. **Neff**. Nor would I personally be willing to bet the country's future in terms of solving this problem necessarily on one site. I do not think that is prudent.

The **Chairman**. You do not think what is prudent?

Mr. **Neff**. I have taken your question to mean that would we be willing to bet on one site.

The **Chairman**. I am not talking about betting on one site. I am talking about characterizing one site which during characterization if it is not suitable, then you move to another site. There is no bet in that. There is a savings of a couple of billion dollars potentially, and we are not putting pressure on the first site to be good because we move to the second site if the first one is not suitable.

Mr. **Neff**. In terms of the Deaf Smith County site I have a very high degree of confidence in that site in terms of its ability to be proven out during site characterization. Again, I will just say that Mother Earth carries many surprises for us and we have to be ready for those and understand them.

The **Chairman**. Of course. We understand that. Senator Evans.

Senator **Evans**. Let me just follow up on that. I think you are a little more prudent than the testimony we have had from the central office. At times their enthusiasm is extraordinary. In testifying on the potential of characterization, as I remember, Mr. Chairman, Mr. Rusche said he thought it was over 99 percent that anyone of these sites would be successfully characterized, or something close to that. We will have to dig back into the record and find out what it was, but it was in the high 90s. I remember at the time making a comment about just about as pure as Ivory Soap.

Even if you are at 90 percent, and I ask anyone or all three of you, even if the potential for successful characterization is 90 percent and it costs a billion dollars to do each one, is it prudent to do all three at the same time, or is it prudent to do one at a time with 90 percent certainty that it would be successfully characterized and the potential of saving $2 billion? Then the other side of the scale is of course the potential delay in a final site selection.

Mr. KALE. If you do not mind, I will try to answer that question. I think Jeff put it very well. Mother Earth can hold so many surprises, and they can be very major ones. I think under the present circumstances in terms of what we need to find out, and the degree to which we are going to have to establish the reasonableness, almost to the point in some cases of a certainty with the Nuclear Regulatory Commission, my opinion is that we should go ahead with characterization of all three sites. Surprises can happen and normally they are not small ones. They are major ones that could produce a major setback in, for example, if we just pursued one site and we could find anywhere along the line we are with a site that will not be supportable in the licensing process and have to start a new one and have lost that time. Time does translate into money.

So it would not be just a pure savings. We would have lost the period of time that we could have been going in parallel. In my opinion we should proceed with all three sites.

Senator EVANS. I thought that that would be the response. That is with a 90 percent certainty. That was the framework of the question, 90 percent certainty. What if the certainty were 95 percent? Still go on all three sites?

Mr. KALE. I guess we have not done enough operations analysis or that type of work to really try and quantify the answer.

Senator EVANS. In other words, you are saying that even if it is 100 percent certain that you could get all three sites, then what would you do?

Mr. KALE. I guess by definition 100 percent says that we know all there is down there and we could proceed. Lacking 100 percent information, then the question becomes just where are the surprises and how well do we know them. I cannot quantify it.

The CHAIRMAN. We can quantify the $2 billion.

Senator EVANS. The trouble is that in distinguishing between government and the private industry, one of which may be aimed at health and safety and the other one at profit, it is also true that government has precious little concern over money most of the time, or at least not as much as the private industry might. It seems to me at some point when the odds are high enough, it does not make any sense to continue ahead tripling the money spent.

I do not know where that point is, but it certainly is not 100 percent. I am surprised that it is higher than 90 percent, but then the head office was saying in testimony here not so many months ago that their view of it was that it was a considerably higher figure than 90 percent. I will go back and look up what he said. Assuming it is 95, 96, 97 percent, still go all three?

Mr. KALE. I will answer it this way. Based on what we know today, and regardless of what the number is, I do not know if any of us have quantified that in terms of probability and statistics. I am not sure that is possible to do. Based on the advice that we have continued to get from the scientists, and we have sought opinions in various places from scientists that we have brought in from time to time, based on what I know, I would still proceed to characterize all three sites in parallel.

Senator EVANS. That sounds like you do not know a whole lot and so there is a lot of uncertainty out there. What gives you the certainty to say that everybody says that it is at least 90 percent or better that you can successfully characterize anyone of these?

Mr. KALE. I think it is the nature and the potential magnitude of that uncertainty. If it comes, it is going to be, I suspect, a large one, a major one, ones that are difficult to work around if not impossible. I think it is the nature of the uncertainty.

Senator EVANS. It is either qualified or disqualified. It does not make much difference how big it is. If it is a disqualifier, it is a disqualifier. You have 90 percent chance that it would qualify. It seems to me it does not make much difference whether it is a big one, or an unusual one, or an ordinary one, or a series of small ones. They all add up to the same thing, do they not?

Mr. KALE. Yes, sir. I guess it is the nature of that surprise. We are probably not going to find it out, if it is there at all, until we get down into the underground and actually see what is under there.

The CHAIRMAN. If the Senator would yield?

Senator EVANS. Yes.

The CHAIRMAN. The French are characterizing only one site, I might add at a cost substantially less than a billion dollars. They are also drilling exploratory shafts, small shafts, in a number of other sites. They feel they will have a very high degree of confidence in that. Are they being imprudent in proceeding with only one full characterization?

Mr. KALE. Mr. Johnston, I am not familiar with their program. I cannot comment on that. I again comment that in terms of the stakes here in this country, to site and get the design information, the licensing information that we need, my opinion is that we need to do this to give ourselves the assurance that we can bring a repository into operation.

The CHAIRMAN. Have you done time line studies as to how much time it would take to disqualify so that you cannot do them sequentially considering the 3,000 tons a year, or whatever figure you would use?

Mr. KALE. No, we have not.

The CHAIRMAN. How can you then say it is imprudent? You are talking $2 billion and you say it is necessary to characterize three sites simultaneously. Is not the answer to that question necessarily one that depends upon time, probabilities in time? If it costs one year and you can say that is only 3,000 tons. You can store another 3,000 tons on site, or maybe it is ten years, or maybe—Is that not a question of probabilities that would have to be taken into consideration?

Mr. KALE. It is certainly a question of probabilities, timing, the cost of money if one looks at deferred operation in terms of just going in series. I agree.

The CHAIRMAN. Excuse me for interrupting.

Senator EVANS. The net present value of something spent today is pretty big compared with something down the road a ways. I am not so sure that if you start doing a real true analysis—Apparently nobody has done this, is that correct?

Mr. KALE. To my knowledge, nobody that I know of has done that. As of today we have proceeded along the path of developing the three sites.

The CHAIRMAN. If the Senator would further yield, we put in a requirement for three characterizations simultaneously when the information given to us cost $60 million per site. There is nothing magic in the three, but it was related to $60 million of characterization cost.

Senator EVANS. It seems to me that that might be a pretty useful thing for us to be doing. Either the Department, or if they feel it is unwise to do, we can get somebody else to do it. Somewhere along the line a thorough analysis of the consequences of delay, and the consequences of doing all three of these and relating that in some way to the chances of successful characterization is really an analysis that is pretty fundamental. It should have been done. It would have been done under any normal circumstances if you got into the private sector as to how we spent money and where and under what circumstances, and comparing it against the risks in getting what we are trying to get to.

One question on the Texas site. You talk about impact funds and the feeling—Is it correct to say that currently you have payment in lieu of taxes, or roughly the equivalent of payment in lieu of taxes to the units of local government? They are confined to general units of government?

Mr. NEFF. The language in the law is unit of general local government.

Senator EVANS. I understand that may well be a problem. It would be a problem in our State as well. The school districts are not really units of general local government, but they are certainly among the most needed in terms of any impact funds. Do we have the same situation in Washington?

Mr. ANTTONEN. I do not believe we have the same situation. In fact, I met with the State in my monthly meeting last Friday and we talked about it, and they indicated they are not aware of any major issue right now within the State.

Senator EVANS. There is not a major issue in terms of requirement for funds, or not a major issue in getting whatever impact funds were distributed to the district that needed them?

Mr. ANTTONEN. Whatever impact needed to get it to the districts.

Senator EVANS. I presume they do that because we have a pretty integrated— You can get it, for educational purposes, you can get it to the states and they can in turn get it to the districts necessary. Is that possible in Texas even when you have independent school districts? Would it not be possible to transfer that money to the state and have then in turn transfer it to the school district?

Mr. NEFF. I do not want to represent that it is impossible. We have been discussing this with State people for a couple years in terms of an issue, and they certainly have not brought up a solution. Neither has it popped up in terms of a very intensive set of discussions. It might be something that I should go back and specifically examine.

Senator EVANS. That was the next question I was going to ask. Has this really been brought up as a significant problem by the school districts or local governments, or in your view is it a significant problem? So far you have not had very many people move in anyhow, have you?

Mr. NEFF. We have had about 60 people move in and we are projecting in the local areas numbers that are, let's say, up to five percent or so of the base population. Some of these are very small Texas towns. Vega, which is mentioned in my testimony, has a population of about 900 people. It does not take very many people with children to start impacting it.

Most school boards, as you are probably well aware, particularly if they are talking about construction, they are really talking about one and a half years in advance. So, yes, it has been brought up by them in a very professional and a very forceful manner. While our studies continue to say the impacts will not be significant, we are very concerned about not having any fallback position, if you will, in terms of these payments equivalent to taxes when particularly they are talking about our children in these systems.

Senator EVANS. If that is the case, does that suggest a proposed modification or change in our law in order to allow us to handle that kind of thing?

Mr. NEFF. There are some intricacies here which I probably cannot speak correctly to. Mr. Rusche has testified I believe in front of the committee that legislative authority is required at this point to address that.

Senator EVANS. Are there any other specific, and maybe you can reply for the record on this—are you aware in either of the other two states of any specific changes in law, or modification that would make the job easier, make it go better? Any hurdles or barriers that you run across that really suggest that a modification would be appropriate? If you are not aware of any, fine. If there may be some, you may want to supply that for the record.

Mr. KALE. I cannot think of any at this point right now, Mr. Evans. Perhaps what we should do is provide a response to the record.

Senator EVANS. That is fine.

[The information follows:]

The Department offers the following suggestions on how to improve the process by which affected States, localities and Indian Tribes can participate in the waste program, obtain financial and technical assistance, and provide input into various decision documents: (1) authorize funds appropriated pursuant to the Nuclear Waste Policy Act of 1982 to be used to provide payments-equal-to-taxes to special purpose units of local government at the candidate site; (2) authorize the Department to provide grants directly to affected local governments; (3) authorize the Department to provide financial and technical impact mitigation assistance directly to local governments; and (4) authorize the Department to provide financial and technical impact mitigation assistance to affected States, local governments, and Indian Tribes during the site characterization phase.

Senator EVANS. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much, gentlemen. We appreciate your testimony. Next we have Mr. Robert M. Bernero, Deputy Director of the Office of Nuclear Material Safety and Safeguards of the NRC, accompanied by Mr. Robert Browning, Director of the Division of Waste Management of NRC. Gentlemen, welcome. Please proceed.

STATEMENT OF ROBERT BERNERO, DEPUTY DIRECTOR, OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS, NUCLEAR REGULATORY COMMISSION; ACCOMPANIED BY ROBERT BROWNING, DIRECTOR, DIVISION OF HIGH-LEVEL WASTE MANAGEMENT

Mr. BERNERO. Thank you, Mr. Chairman. Thank you for this opportunity to present the views of the NRC on the DOE Program for disposal of civilian high level waste. I have prepared testimony which I would like entered into the record. With your permission I would like to highlight some of the significant points of that testimony.

As you know, we are in the prelicensing consultation phase of the repository program. DOE has the responsibility to conduct site characterization activities to acquire data necessary to evaluate the suitability of each candidate site.

We are reviewing this data as it comes along, and in reviewing DOE's activities and comments, NRC has raised some concerns which are expected in a first of a kind program of this nature. This process has permitted us to narrow the issues and move toward resolution as the DOE program focuses on the areas of concern and obtains more data.

Our effort in this early stage is to identify issues from NRC's regulatory perspective as early as possible, and to insure that DOE is addressing those potential licensing issues in an appropriate way.

The prepared testimony discusses some of our concerns about site characterization at the three sites, but I will not repeat that material now. I will touch only on one comment that we made in our mission plan amendment comments, and then I would like to bring out one technical issue, quality assurance, that has come up and I think merits special comment in order to reflect on the lateness of the hour.

In our comments on the draft mission plan amendment, there was language in that amendment linking the schedule for receipt of spent fuel at the monitored retrievable storage facility to NRC's issuance of a construction authorization for the repository.

I would like to note that the proposed linkage between the repository construction authorization and MRS operation, both of which are projected for 1998 under DOE's revised schedule, could lead to at least an appearance of undesirable and unnecessary pressure to issue the repository construction authorization.

The CHAIRMAN. I might add at that point that that linkage was a political one caused by the concern of Oak Ridge that their MRS would be the sole repository. That is the reason for that. It seems to me that once we demonstrate that repository is well underway and there is a real commitment to it, that perhaps the linkage may no longer be necessary to satisfy Oak Ridge. Once you have a real program going I would think that ought to satisfy them. Time will tell on that.

Mr. BERNERO. If we turn to the NRC/DOE interaction, in general I would say that our interaction has progressed quite well. We are working on a procedural agreement which we drew up in 1983. We are following that agreement. The first half of this year we had a number of technical meetings which I have noted in the testimony. I do not think there is any need for me to review those.

Due to uncertainties in DOE's schedules, particularly regarding when exploratory shafts will be sunk, NRC staff will be working with them to focus near term technical meetings on those concerns related to surface based testing strategies. This is a matter of priority to expedite the work of surface characterization. Although we recognize that characterization at depth is ultimately necessary for complete site characterization.

I would summarize by saying our pre-licensing consultation has been generally adequate to enable us to perform timely reviews of their programmatic documents. As in any major program involving approaches that go well beyond normal practice, we are certainly going to find issues, and we will continue to work toward improved understanding in pursuit of these issues.

In general, I would say that the program is proceeding with some success. I do want to point out the one technical issues I mentioned earlier, quality assurance. We asked the DOE when they were ready for our first major quality assurance audit, and this was at the Nevada site. We did a quality assurance audit where we had both technical expertise and programmatic expertise set out to do that.

Our testimony indicates that we made some findings. We found deficiencies, and we concluded that their quality assurance program is not yet fully in place, and we noted those deficiencies. We are meeting with DOE this week about them. I would just like to add that we are not discouraged by this finding. The agency, the NRC, has gone through quality assurance program audits many times in the past, and it is not uncommon for us to go into a major program and find deficiencies. Nevertheless, we will pursue these with DOE, and I expect that a successful program can ensue from this.

In conclusion, I would say from the NRC point of view there is no technical reason why we should not continue with the three sites. I think we are operating in a method that will allow us to expedite the pursuit of this site characterization. The only thing I might add, I believe in the earlier testimony the DOE representatives suggested a three month review of the site characterization program. We envision a six month review of that rather large document.

I would like to turn to your questions now.

[The prepared statement of Mr. Bernero follows:]

PREPARED TESTIMONY

SUBMITTED BY THE

UNITED STATES NUCLEAR REGULATORY COMMISSION

TO THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

CONCERNING
DEPARTMENT OF ENERGY'S PROGRAM
FOR DISPOSAL OF CIVILIAN HIGH-LEVEL WASTE

PRESENTED BY

ROBERT BERNERO, DEPUTY DIRECTOR
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

SUBMITTED: JUNE 29, 1987

Mr. Chairman, members of the Committee, thank you for this opportunity to present the views of the Nuclear Regulatory Commission (NRC) on the Department of Energy's (DOE) program for disposal of civilian high-level waste. I have with me Mr. Robert Browning, Director of NRC's Division of High-Level Waste Management.

As you know, we are in the pre-licensing consultation phase of the repository program. DOE has the responsibility to conduct site characterization activities to acquire data necessary to evaluate the suitability of each candidate site for an application to the Commission for construction authorization. At this stage, DOE's activities include only surface testing. While surface testing can provide a great deal of information about a site and could potentially reveal a condition which could disqualify a site, it cannot provide enough information to determine that a site is suitable for licensing as a repository. Eventually DOE expects to drill an exploratory shaft to perform in situ testing at repository depth. Before sinking such a shaft at any candidate site, DOE must submit to the Commission a plan for site characterization activities for review and comment. This investigation at depth, together with the surface investigation, is expected to provide the necessary data to permit judgments of site suitability for licensing.

In reviewing and commenting on DOE's activities and documents, NRC has raised concerns, which are to be expected in a first-of-a-kind program of this nature. DOE has recognized and responded to NRC concerns, although most can only be settled over time, as part of DOE's site characterization program. This process has permitted us to narrow issues and move toward resolution as the DOE program focuses on the areas of concern and acquires more data. For example, we have reviewed DOE's draft and final Environmental Assessments for the potential repository sites. We are currently reviewing DOE's Final Mission Plan Amendment. Our effort at this early stage of the program is to identify issues from NRC's regulatory perspective as early as possible and ensure that DOE is addressing those potential licensing issues in an appropriate way. Our next opportunity to consider this question will be in our reviews of the DOE Site Characterization Plans (SCP's), the first of which is scheduled to be issued in the fall of this year. We will also be reviewing DOE's semiannual progress reports as required by the Nuclear Waste Policy Act (NWPA).

I would like to discuss some of our concerns about site characterization at the three sites recommended to and approved by the President for characterization as candidate sites. I will then discuss our comments on DOE's Draft Mission Plan Amendment dated January, 1987 and, more generally, our interaction with DOE. Finally, I would like to describe our quality assurance activities. I will be happy to respond to any questions from the Committee.

Site Characterization Program

NRC staff comments on DOE's final Environmental Assessments (EA's) for potential repository sites were provided to DOE in our letter of December 22, 1986 after review by the Commission. As part of the prelicensing consultation between DOE and NRC, the intent of our comments on the EA's was to assist the DOE in preparing high quality site characterization plans. As you know, Mr. Chairman, from our previous testimony and correspondence, we noted in this letter to DOE that DOE had made significant efforts to respond to each of the NRC staff's major comments on the draft EA's and had resolved many of these comments. However, in each of the final EA's, the staff review identified some remaining potential licensing issues.

For example, at the Hanford site we feel that the groundwater flow system and the ability to construct a repository in a medium (basalt) with high stresses must be better understood. Additional data and analysis about such characteristics as tectonic stability and the ability of the basalt system to retard movement of radionuclides are needed to determine whether regulatory requirements are met. Additionally, container lifetime estimates for Hanford will require considerably more analysis by DOE.

At the Yucca Mountain site, the major issues include geological concerns such as the presence of potentially active faults and related ground motion, the potential for volcanism, and the origin and significance of mineral veins in the area. Hydrology is also a concern in the saturated and unsaturated zones; groundwater flow patterns and regimes and travel times have yet to be fully determined. As at Hanford, the ability of the medium (tuff) to retard movement of radionuclides is not yet well understood.

At the Deaf Smith site, most of the licensing uncertainty has to do with the characteristics of the salt in which the repository would be located. Salt can dissolve unevenly along faults, leading to undesired flow of water. The potential for heterogeneities in salt may make construction difficult and retrievability of waste hard to maintain. It may be difficult to seal shafts against inflow of groundwater. Salt can contain brine inclusions which can move in response to temperature or pressure differentials and the corrosive brine could potentially threaten waste packages.

While NRC concerns have been identified for each site, they are not unexpected at this stage of the site investigation and screening process since the existing data base is limited. While these issues should not disqualify the sites from further testing to determine their suitability for the repository, they could have serious implications for the licensability of each site if they are not satisfactorily resolved through information gained from site characterization. Hence, these concerns need to be addressed as the DOE develops and implements a Site Characterization Plan for each site. The purpose of site characterization, as defined by the NWPA and NRC's regulations, is to develop data to evaluate the validity and significance of such concerns relative to site suitability for licensing.

NRC Comments on DOE's Draft Mission Plan Amendment

On April 7, 1987, the Commission sent DOE its comments on the Draft Mission Plan Amendment. In the Draft Amendment, DOE has made significant commitments involving NRC and the States and Tribes; including specifying activities on interactions with NRC on technical issues, implementation of [illegible] assurance program, and provisions for greater involvement by the States and affected Indian Tribes in the technical program. These are substantially the same activities which NRC identified to DOE in comments on the Draft Project Decision Schedule on October 24, 1985, as needing to be completed in a timely fashion to permit an efficient licensing review. The NRC staff will cooperate with the DOE in implementing these. To ensure that NRC staff and DOE are progressing satisfactorily in the prelicensing phase, the Commission has also asked DOE to address this topic in future briefings to the Commission. In addition, the Commission has requested NRC staff to provide periodic assessments of progress in the area. The Commission was briefed by DOE and received the staff's assessment in June of 1987. The Commission also was briefed by representatives of potential host states and affected Indian tribes regarding their assessments of progress in this area.

It should also be noted that the Draft Mission Plan Amendment includes language linking the schedule for receipt of spent fuel at the Monitored Retrievable Storage (MRS) facility to the NRC's issuance of a construction authorization for the repository. The NRC letter to DOE emphasized that the basis for the NRC's review of the license application for the repository and the granting of a construction authorization will be public health and safety and will not include consideration related to the MRS schedule for receipt of spent fuel. The proposed linkage between the repository construction authorization and MRS operation, both projected for 1998 under DOE's revised schedule, could lead to at least an appearance of undesirable and unnecessary pressure to issue the repository construction authorization. For this reason and because there is no technical basis for the linkage, the NRC opposes this provision.

NRC/DOE Interaction

The NRC reviews and consultation with DOE take place in the context of the requirements of the NWPA. To facilitate this formal process, NRC and DOE in 1983 entered into a Procedural Agreement which outlines procedures for consultation and exchange of information during investigation and characterization of sites. Under this Procedural Agreement, pre-licensing consultation interactions consist of technical meetings, data and document reviews, and prompt information exchange by an NRC On-Site Licensing Representative (OR) at each DOE project office.

The need to increase the effectiveness of NRC/DOE site-specific technical interactions has been a focus of DOE and NRC management attention for all three DOE projects. Since DOE has been almost continuously occupied with writing the Environmental Assessments (EAs) and SCPs over the past three years -- documents which then consume NRC's time and resources during the comprehensive review required -- it has been difficult to find mutually acceptable times to hold as many technical interactions as would have been desirable. However, both NRC and DOE management have committed to improving the extent and effectiveness of technical interactions, particularly formal technical meetings.

During the first half of 1987, four technical meetings have been held (Hanford Hydrologic Testing, Texas Exploratory Shaft Design, Nevada Exploratory Shaft, Issues Hierarchy and and Performance Allocation). The NRC staff considers that these meetings succeeded in making progress toward resolving technical issues previously identified by NRC staff.

For example, during the week of April 5 at Hanford, Washington, NRC and DOE staff met to consider hydrologic testing that should be performed before sinking the exploratory shaft at the Hanford site. The meeting included State and Indian tribe representatives as active participants. The manner in which DOE conducted this meeting, both in its thorough treatment of the technical issues and its achievement of an effective dialogue with interested parties, is an example of the improvement we believe is needed to reach consensus on such difficult technical issues. On the basis of the information presented by DOE and discussed at the meeting, NRC staff accepted DOE's proposed approach as a logical step. NRC management is committed to continue efforts to improve the effectiveness of these technical meetings, including efforts to assure active participation by States and Indian tribes.

Due to uncertainties in DOE's schedules, particularly regarding when exploratory shafts will be sunk, NRC staff will be working with DOE to focus near-term technical meetings on specific concerns related to surface-based testing strategies. For example, in our comments on the Draft Mission Plan Amendment, we indicated that some surface-based testing may be needed prior to construction of the shafts because (a) shaft construction may render some testing impossible or useless; and (b) such testing may reveal information about site suitability important to know before major resources are committed for shaft construction. NRC staff considers that significant progress toward resolution can be made for some areas of technical concern at each site through surface-based testing.

Technical meetings focused on surface-based testing strategies will also allow the staff the opportunity to determine how DOE is incorporating into the SCP's many of the concerns identified in our final EA comments.

Another example of interaction was the briefing of the NRC staff and the affected States and tribes by the DOE on its issues hierarchy and issue resolution strategy. This strategy lays out a logical and rigorous way of identifying issues and the data needed to resolve them. How the DOE implements the issue resolution strategy is the key to whether it is heading in the right direction; NRC staff review of the SCP's will assess progress in this area.

In summary, the NRC/DOE prelicensing consultation has been generally adequate to permit NRC to perform timely reviews of DOE's programmatic documents. As in any major program involving technical and engineering approaches that go well beyond the normal practice, issues which need to be addressed and resolved are being identified. Therefore, NRC and DOE continue to work toward improving communications on these types of issues to ensure they are being addressed as early as practicable. Moreover, NRC recognizes the need to develop additional regulatory guidance to assist DOE in this aspect of its program development. Currently, both NRC and DOE are working to improve our interactions as well as to ensure that States and Indian tribes have opportunities to participate substantively in these interactions, as consistent with Sections 116, 117 and 118 of the NWPA.

Quality Assurance

One of the key considerations throughout our interaction with DOE, during both the prelicensing phase and the formal licensing process, is quality assurance (QA). DOE has committed to having qualified quality assurance programs in place for site characterization activities that are important to public health and safety and to waste isolation. This commitment is necessary since most of the data collected during the site characterization program is expected to be utilized in the licensing process and must, therefore, be of demonstrable quality.

DOE continues to make progress in developing its QA program. The NRC staff's assessment of DOE's QA program began with observation of certain DOE audits. After DOE determines a part of its program is qualified, NRC staff audits selected critical portions of the programs. This is to ensure that DOE's QA program is checked by DOE to its satisfaction first and then checked on a sample basis by the NRC.

One of the lessons we have learned from our experience with QA at reactors is that it is essential to combine examinations of technical quality with QA reviews. As a result, when we do a QA review, we examine the technical quality of DOE work as well as the procedure and documentation involved. For this purpose, we send specialists in the relevant technical area with our QA specialists to audit DOE activities.

The NRC staff's first audit of the implementation of this program was conducted the week of June 8, 1987. The area audited was part of the geochemistry program for the Nevada project. The NRC audit team consisted of personnel with expertise in both quality assurance and geochemistry. The NRC audit did find specific problems, particularly in documentation of personnel qualifications. We concluded that the DOE QA program is not fully in place yet and needs some improvement prior to conduct of site characterization work in the area of geochemistry. We are meeting with DOE this week to go over our findings and determine what corrective actions DOE will take in this particular technical area and in its own audit program.

In conclusion, Mr. Chairman, we believe that there is no technical reason relevant to NRC's responsibilities why site characterization should not continue at the three sites approved by the President. The high-level waste repository is a first-of-a-kind facility, involving complex, unique technical issues which can only be resolved through a detailed site characterization program. The effectiveness of the interactions between DOE, NRC, and the potential host states and Indian tribes during the pre-licensing phase to address technical concerns continues to be a matter of high priority for NRC management. This is necessary to permit early resolution of NRC staff technical concerns and thus facilitate an efficient and expeditious licensing review. We are committed to continue our efforts to improve this area whenever practicable.

The **Chairman**. Thank you very much, Mr. Bernero. You state in your statement and you just repeated that there is no technical reason relative to NRC's responsibilities why the site characterization should not continue at the three sites approved by the President.

It is well know, Mr. Bernero, that the NRC is very thorough in their work, and indeed you should be because we want a high degree of confidence and safety in the quality assurance which you provide.

When you say there is no technical reason not to proceed, you are saying, in effect, in plain language that the program is not in disarray, that we are ready to proceed with site characterization and that it would—let me stop the sentence right there. Is that correct?

Mr. **Bernero**. Yes, sir. I would say it is the NRC's position that we are prepared to pursue with the review of DOE site characterization reports in their program.

The **Chairman**. Mr. Bernero, we had the representatives from the three affected states and from Tennessee as well speaking about all the various concerns about the three sites. In the case of Nevada the seismic tectonic activity, the nuclear test range; in the case of Deaf Smith, the Ogallala Aquifer, the agricultural concerns, you know the concerns for the three sites. The testimony we have received from DOE is that, yes, those are legitimate considerations but they can be answered only by site characterization.

Would you concur with that statement?

Mr. **Bernero**. Yes, sir. We have identified the same concerns in our comments to DOE, and we have taken the position that these concerns merit pursuit, they merit investigation but their answer can come only from methodical site characterization. We have found nothing at this point that would disable or disqualify a site.

The **Chairman**. In the selection of the three sites, the process by which we got down to the three sites, does that have your seal of approval as well?

Mr. **Bernero**. The screening process by which we identified, or DOE identified these three sites and got their approval by the President has been found acceptable

The **Chairman**. You have people there at the sites during this process?

Mr. **Bernero**. We have resident personnel at the Hanford site and at the Nevada site. We do not yet have a resident at the Texas site.

The **Chairman**. Will you have one?

Mr. **Bernero**. We expect that we would as that site develops staffing and capability.

The **Chairman**. I believe the National Academy of Sciences also has resident experts, do they not?

Mr. **Bernero**. I would have to defer to——

Mr. **Browning**. To the best of my knowledge the National Academy of Science does not have resident personnel at any of the sites.

The **Chairman**. I see.

Mr. **Bernero**. For clarification, you referred to the process by which DOE narrowed down to the three sites that were approved by the President for characterization. If I could just clarify that, we did not get involved in the methodology for ranking the sites, lead into the site selection. As we have indicated before in answers to technical questions, we felt that was really outside of our realm at this particular point and time because we would ultimately have to review the adequacy of the individual sites. To get involved in that selection process we considered at the time this would not be appropriate. We did not get involved in that methodology.

The CHAIRMAN. You do, however, consider the three sites to be adequate at this stage of knowledge, pre-characterization?

Mr. BROWNING. We consider them acceptable sites for the purpose of site characterization in order to get information about them to see if they would be licensable.

The CHAIRMAN. I asked the question in the context of the call by some people to have a moratorium to appoint some panel of experts. They do not quite agree on what kind of experts. Some say lawyers, some say scientists, some say environmentalist, some say a combination of all of those things. Some say with a broad range of representatives of the public, but to stop the program and study it before we go forward.

As I am hearing from your testimony, it is that the process up to this point has been adequate. That the real questions about these sites can be answered only after characterization, is that correct?

Mr. BERNERO. That is correct. Orderly site characterization gathering the technical data.

The CHAIRMAN. There is nothing further that you are here to recommend to us prior to that characterization that we could do, or is prudent, or is necessary?

Mr. BERNERO. No, there is not.

The CHAIRMAN. You mention in your statement meetings between DOE and NRC technical staff. Have these meetings been successful interactions?

Mr. BERNERO. Yes, in general they have. Of course it is a continuing process. As the information develops we have to pursue these. We have had a generally successful interaction with DOE.

The CHAIRMAN. Senator Evans.

Senator EVANS. Thank you, Mr. Chairman. Let me follow through a little on the Chairman's questions. Is it not true that the screening process up to now and the selection of the three sites was virtually totally outside the NRC responsibilities?

Mr. BERNERO. Yes. It was really a DOE process. We did not review and approve it.

Senator EVANS. So when you are answering the Chairman's question would it not be more accurate to say that you were not involved?

Mr. BERNERO. That is correct. As Mr. Browning clarified. We do not find that the three sites that came out of that process are evidently poor or unacceptable.

Senator EVANS. But even to say that would presume that there is some analysis of all the sites that were looked at, and you did not do any of that, did you?

Mr. BERNERO. We have done only the analysis of these three sites, and we have already passed on to DOE in our comments on their initial reports the concerns, the ones we have mentioned before, none of which we have found disabling.

Senator **Evans**. But you would have no comment as to whether the analysis procedure that DOE went through to get to the three sites was fair, excellent, poor, faulted, or any other——

Mr. **Bernero**. No. NRC has no position on that.

Senator **Evans**. You mention that you believe the review of the site characterization study should take six months rather than three months?

Mr. **Bernero**. Yes.

Senator **Evans**. There is a suggestion by at least some of the previous panel that they would have material out in August, but the final report would not be out until October. Therefore, there would be some advance time to study. Are you suggesting that, assuming there is an October deadline for a final report, that there should be a six month period from the final report to review it?

Mr. **Bernero**. I believe that is what we have already told DOE, and I will defer to Mr. Browning to clarify that.

Mr. **Browning**. I believe in our comments on the project decision schedule, the six month time period was laid out formally. Before that that was well understood. I think the three months time frame probably relates back to a commitment made that in the event that the exploratory shaft sinking was a limiting item in the production path that DOE wanted to pursue, that we would be willing to concentrate our efforts on all the technical questions related to sinking of exploratory shaft. In that respect we would commit to a three month turn around time for that particular piece.

That does not seem to be of concern right now with the lack of funding for the exploratory shaft. I would presume we go back to the six month time frame.

Senator **Evans**. Even leaving the lack of money aside, if I remember all of the dates we heard today, it seemed to me that taking the Hanford site at least as one example, the plans for the hydrological studies and the rest that would be carried on prior to the sinking of any major shaft. There was a concern about the impact of a major shaft on the results of hydrologic testing, and that was not even going to be ready until June of 1988.

Mr. **Bernero**. That is correct.

Senator **Evans**. That certainly is a lot more than six months after the October 1987 time frame for the site characterization study. We will have to read the testimony to make sure of all those dates, but if that is the case, then certainly there is no big rush for 90 days after October 1st, at least as far as the Hanford site is concerned, and probably as far as the Deaf Smith County site is concerned. they are not even close to sinking a shaft there. I would guess the same is probably true with hydrologic and seismic studies at the Yucca Mountain site as well.

In fact, you in your testimony mention on page three your feeling at the Hanford site, "We feel that the groundwater flow system and the ability to construct a repository in a medium basalt with high stresses must be better understood. Additional data and analysis about such characteristics as tectonic stability and the ability of the basalt system to retard movement of radionuclides are needed to determined whether regulatory requirements are met."

You do not say so, but would you judge that those are analysis that should be done prior to the drilling of any major bore hole?

Mr. Bernero. I think it is our understanding that the groundwater work, much of it would be done before sinking a major shaft. I think in our previous evaluations we expect that the final resolution of both groundwater and the rock stress questions would require the shaft to be sunk, put them to bed.

Senator Evans. I am sure that that is the case. Before you get all the final data you would have to sink the shaft. I took it from your statement on page three, and from previous statements made, that at least a good share of the hydrologic work, in order to be effective, ought to be done before any major shafts are sunk, which in themselves could have some effect on the accuracy of those tests.

Mr. Bernero. The groundwater, yes. The groundwater studies would be what is called surface characterization. You do not want to disturb it with the shaft until you have that in hand.

Senator Evans. When you say ground water, are you talking about something close to the surface?

Mr. Bernero. The groundwater all the way down.

Senator Evans. Whether it is confined or unconfined?

Mr. Bernero. Yes.

Senator Evans. Finally on the MRS and the deep repository you talk about the delinkage, and I fully understand the Chairman's comment that this was part of a political compromise with the State of Tennessee.

Do you believe that if there were available, or if we could have available one or several monitored retrievable storage sites, that that in itself would ease the problem in terms of timing for the construction of a final repository?

Mr. Bernero. Certainly it appears logical that having one or more MRS facilities available would do just that, relieve the schedule pressure. We have said before we do not see a health and safety reason for needing such a facility, but nonetheless, there are programmatic advantages that are available from that.

Senator Evans. You say health and safety. If we have a delay, however, continuous delays on the deep repository and it just keeps getting pushed off into the future, as it well might in spite of our best effort, then do you have some health and safety concerns? And if we do not move ahead on an MRS, do you have any health and safety concerns over the resulting requirement that spent fuel must be stored at perhaps 100 or more reactor sites for an extended period of time?

Mr. Bernero. I think the concern would be less as to the longer term storage of the spent fuel then it would be to the question of waste confidence itself. The Commission needs to periodically reevaluate its confidence that there is indeed a solution to the high level waste disposal problem, and that would be the greater question in my mind.

Senator Evans. Does it not make sense, however, that it is easier and you have more confidence in the storage and management and the monitoring of fuel prior to getting into a deep geologic repository if you only had two or three places to watch over it instead of 100?

Mr. Bernero. There are certain programmatic advantages to that. Of course, you realize that each of the reactors generating the spent fuel is, of course, storing the fresh fuel. We are, of course, monitoring that.

Senator **Evans**. The difference would be between storing it for a temporary period of time, or relatively short period of time, and the potential that it may have to be stored there for——

Mr. **Bernero**. For decades.

Senator **Evans**. Yes, for decades, even after the closure of some of the plants. You have no concern about that as being just statistically a tougher thing to deal with?

Mr. **Bernero**. As long as the reactor owner has the material there, the reactor owner is held under the terms of his license. They may not be operating the plant, but they are still constrained by the terms of the license. There are certain programmatic advantages to consolidating such storage.

Senator **Evans**. Just the fact that there are 100 sites rather than three does not give you any pain as far as statistically causing or making perhaps more possible an error, a difficulty, that would occur at one of the 100 sites rather than one of the three sites? It just seems to me statistically that it jumps out at you.

Mr. **Bernero**. It requires that much more attention to achieve the same level of vigilance per site.

Senator **Evans**. We can have 100 percent vigilance and still have an accident because sometimes accidents happen that even the maximum of vigilance cannot foresee. Is it not likely to have one of those happen more frequently if you have fuel stored at a multiple number of sites rather than just a few?

Mr. **Bernero**. All else being equal, yes, indeed.

Senator **Evans**. Thank you.

The **Chairman**. Following up on that, one of the proposals to be submitted would state that we would have a moratorium on the program. I believe the way it works is there would be a credit against the fee for long time storage of waste at each reactor site.

Now that kind of proposal has been criticized in that it simply multiples the regulatory problem. Instead of monitoring one repository and one MRS, you have to monitor 50 or whatever number of sites on which you would have long-term storage.

Would you comment on that?

Mr. **Bernero**. It is indeed a problem, but the Nuclear Waste Policy Act even seeks—it has a section, if I remember correctly, Section 218—that seeks a way to enable reactor storage at reactor, or near reactor storage of spent fuel.

From a health and safety point of view, practical technology can be applied to achieve acceptable safety in such storage. As I have said before, you are talking about that many more sites. It is a dilution of regulatory attention. It needs more inspectors, more surveillance, more vigilance in quantity. Certainly there are these programmatic advantages.

If you consolidate the storage of spent fuel over many decades, you simplify that process. You simplify the problem of providing the necessary surveillance, even after the reactor is no longer operating.

The **Chairman**. How about the cost, do you have a view of what the cost would be?

Mr. **Bernero**. We have not analyzed it. There are so many possible combinations. We periodically look at the reactors from the standpoint of their present storage. The various laws on this do impose constraints on the freedom with which you can consider alternatives.

The **Chairman**. Of course this is a legislative proposal, so they would rewrite the law. There are various kinds of moratoriums that are stated. Many of the places that are scheduled to get the waste simply do not want it, so they come up with all kinds of new proposals to avoid that. I was going to say to avoid the inevitable. It is at least inevitable that the waste exists and will have to be put somewhere, or maintained somewhere, whether it is on reactor sites, or in a repository. I happen to believe that a combination of the MRS and repositories is the proper way to do it.

Gentlemen, I want to thank you very much for your testimony today as well as that of the previous panel. I would say that both panels today have given government employees, sometimes known as bureaucrats, a good name. For that we thank you.

The committee is adjourned.

[Whereupon, at 4:52 p.m., the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses to Additional Committee Questions

Department of Energy
Washington, DC 20585

August 14, 1987

Honorable J. Bennett Johnston
Chairman
Committee on Energy and Natural
Resources
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

On June 29, 1987, Stephen H. Kale, Associate Director, Office of Geologic Repositories, Office of Civilian Radioactive Waste Management appeared before the Committee on Energy and Natural Resources to discuss DOE's nuclear waste siting process. Mr. Kale was accompanied by John H. Anttonen, Project Manager, Basalt Waste Isolation Project, Richland Operations Office; Donald L. Vieth, Director, Waste Management Project Office, Nevada Operations Office and Jeff O. Neff, Project Manager, Salt Repository Project Office.

Following the hearing, you submitted written questions for our response to supplement the record. Enclosed are the answers to those questions which have also been sent to the committee staff.

If you have any questions, please have your staff call Mike Gilmore or Tom Todd on 586-4277. They will be happy to assist you.

Sincerely,

Thomas Todd
for Robert G. Rabben
Assistant General Counsel
for Legislation

Enclosures

Celebrating the U.S. Constitution Bicentennial — 1787-1987

Questions from Senator McClure - June 29 Hearing

(DOE Witnesses)

1. (to Stephan Kale, DOE-HQ) There has been a lot of interest in and speculation about the recently announced solicitation for the "Super-Integrator" (real name: "System Engineering, Development, and Mangement") contract, which, as I understand it, would involve the selection of a contractor to oversee and coordinate all aspects of the high-level waste program.
   a) Could you elaborate on the responsibilities to be assigned to the "Super-Integrator"?
   b) What kinds of qualifications and expertise will be considered in the seletion of this contractor?
   c) If a contractor is selected who already has work under the program, how will conflict of interest be dealt with?
   d) What is the schedule for final selction?

2. I notice that, according to the testimony from the three site managers, Washington has received considerably more grant money ($23.8 million since 1983) than either Nevada ($15.3 milion since 1983) or Texas ($2.5 million for FY 1987). Is there any reason for the differences? Is this a function of the States' requests, or are the grant amounts determined solely by DOE? Do you notice any better relationship with Washington as a result of the larger grants, which I assume translates to a higher interaction level?

3. It appears that the C & C (consultation and cooperation) negotiations are moving along at a snail's pace, if at all.

Could you give us your impressions as to the reasons why the States are resisting this process?

4. (Texas - Jeff Neff)
   a) Please elaborate on the Department's plan and schedule for land aquisition at the Deaf Smith, Texas, site.
   b) You mentioned land value in the agricultural area near Deaf Smith as being part of your study of socioeconomic impacts. Have you noticed any changes in land value to date?
   c) DOE is presently moving its offices to the Deaf Smith area, and this will result in a rather large influx of people (approximately 800), in a relatively short period of time, to a relatively low population area. Yet DOE says they can't identify any significant adverse impacts from this immigration of workers. What about shoools, housing, services, and the like? Will this area be able to absorb the influx easily?

5. (Nevada - Donald Vieth) I understand that the Nevada State Legislature recently passed legislation creating a new county--"Bullfrog County"--in the area in which Yucca Mountain is located. What effect will this have on the high-level waste program? What do you think was the purpose of this legislation? How will this effect Nye County residents, State revenues (payments-equal-to-taxes), local revenues, grants, etc.?

6. The Nuclear Waste Policy Act provides a number of means by which affected States, localities, and Indian Tribes can participate in the waste program, obtain financial and technical assistance, and provide input into various decision documents. However, new ideas are surfacing all the time on additional ways to enhance the States' role, not the least of which is S. 839--the Incentive Package Bill that Senator Johnston and I introduced earlier this year. Since you people are closest to the actual interactions with the States and local governments, perhaps you could give us suggestions on how to improve the process (definition of "local units of government", proportionment of grants between States and local governments, impact aid during site characterization phase, etc.).

7. All of us here are concerned about the tremendous costs associated with site characterization as planned by the Department. While I would be first to agree with the Department that thorough scientific studies at these sites is essential in order to demonstrate the site's suitability (or unsuitability) for the waste repository, I wonder if there might be a way to proceed that would allow the least expensive testing to be done first, so that if these tests result in disqualification of the site, further, more expensive testing (such as shaft sinking) would be avoided. Let's assume that schedule is not a consideration. Do you

have any suggestions as to a logical sequence of testing that could result in cost-savings?

8. Several proposals are floating around Congress to halt all work on the first repository sites while an "independent panel" of some sort reviews the genesis of the entire high-level waste program to date. Some of these proposals even suggest that a new, nation-wide search be undertaken. What is your feeling about the merits of such a proposal? What would this moratorium do to the work now in progress at your sites? Do you think that any State, under any circumstance, no matter how "clean" and unbiased the selection, would react any more favorably to the prospects of hosting a high-level waste repository than the three States we are now dealing with?

FOLLOW-UP QUESTIONS FOR DEPARTMENT OF ENERGY WITNESSES

From Senator Johnston

1. What are considered the major advantages of each rock type?

2. When will each site project be physically ready to drill the exploratory shaft? Do these estimates include time allowance for permitting, land acquisition, etc.?

3. What types of permits will be necessary at each site to drill exploratory shafts?

--Are there any state laws or local ordinances that will bar exploratory shaft drilling? Are there any such laws/ordinances that will make permitting particularly difficult?

--Has the Department made contingency plans to deal with these issues?

4. Approximately how much of the data necessary to evaluate site suitability can be obtained by surface testing prior to sinking of exploratory shafts?

5. The NRC staff has stated that it may be possible to obtain conclusive data for some of the potentially disqualifying factors by surface-based testing prior to drilling an exploratory shaft.

--Does DOE agree with that?

--What technical issues at each site might be able to be resolved through surface testing?

--Is the Department's program structured to address these issues prior to sinking exploratory shafts?

--If not, why not?

--Will DOE have to restructure its test program for fiscal year 1988 if there is a moratorium on exploratory shaft drilling?

6. What physical work is now going on at each site?

7. DOE issued stop work orders to contractors at the Hanford site and the Yucca Mountain site beginning in 1986 because of concerns about inadequate quality assurance programs.

--Please explain why the Department felt these stop work orders were necessary.

--What is the current status of QA programs at these sites?

--When does the Department anticipate all stop work orders will be lifted?

8. The question was asked at the June 29 hearing: From a seismic standpoint, would there be more impact on casks placed in an underground repository than casks placed in surface storage?

9. Is DOE looking seriously at using copper canisters or other especially long-lived canisters for use in tuff or basalt? If not, why not?

10. How will you demonstrate to NRC that casks will last the required 300 years?

11. How will repository design and safety be affected if spent fuel is stored for 30, 40, or 50 years?

12. How will reprocessing affect the design and safety of a repository?

13. How much of the $1 billion cost of site characterization is actually field work? How much of that is evaluation, documentation, administration, management?

14. What do you think about NRC's detailed licensing criteria? Do you have a good handle on the standards that must be met? Is it difficult to develop a test program that you feel will be adequate to meet any questions that NRC might ask? Isn't it true that, to some extent, the criteria that must be met by DOE are still evolving?

15. Is the cost of your test program impacted significantly by the cost of licensing and preparation for licensing?

16. Doesn't NRC's criteria actually in some ways limit the options available to DOE, such as reliance on multiple engineered barriers? Why wouldn't long-lived canisters help with licensing?

Nevada Site

17. Will the presence of faults and potential for fault movement affect the safety of a repository?

18. Suppose a new fault develops in the planned repository block. How will that affect the safety of a repository during construction and operation? After closure?

19. On page 8 of your statement, you say that fault movement is far more significant for surface facilities than for subsurface facilities. Why is that?

--Does that mean that fault movement is more of an issue during construction and operation of a repository than it is for the 10,000 years after the repository is closed?

20. Volcanic rock is abundant in the area, such as the cinder cones near Yucca Mountain. Is this an indication of active volcanism?

--How will issues related to volcanism be resolved for licensing?

21. Very little is known about the rate of groundwater flow in the unsaturated zone. DOE has expressed the view that the flow time to the accessible environment is greater than 20,000 years. The state of Nevada, however, says the flow time varies from less than 1,000 years to greater than 34,000 years.

22. How long would it take for groundwater under the site to travel to an area of discharge into Amargosa Springs?

--How will DOE resolve this issue for licensing?

Deaf Smith Site

23. The potential site is located under a major underground acquifer.

--What are the risks of contamination of the acquifer during construction? During operation, or after closure?

--What would be done to assure that this does not become a problem?

--How will you demonstrate solutions to this potential problem for licensing purposes?

--How does this risk influence the testing program?

24. Is the technology for freezing the ground during shaft construction considered adequate to protect the acquifer? How will you demonstrate this to NRC?

25. There was an accident in the salt site in Gorlebin, West Germany where a worker was killed when the shaft lining buckled under creep.

--What is the relevance of this incident to the Deaf Smith site?

--How would you prevent a similar incident?

26. A major issue raised by Texas state officials about the Deaf Smith site is that it is located in the midst of very productive farm land. You have described how many acres of land will be affected and how DOE will go about acquiring the land.

--But this land is privately-owned and the landowners have been strongly opposed so far. Won't land acquisition be very difficult? Isn't it likely that DOE would have to condemn the land?

--Is it realistic to assume that land acquisition will be completed on a reasonable schedule, or is site characterization likely to be delayed significantly because of this issue?

27. The Deaf Smith site is the only one of the three candidate sites that is not located on federally owned land.

--What type of permitting will be required?

--Isn't there a state law that will make it very difficult to obtain permission to drill an exploratory shaft at the site?

28. DOE's inability to pay impact aid during site characterizationhas been a major issue of contention with the state of Texas. However, DOE plans to move a large number of people into the area.

--Will this be a major problem for the community?

--How will DOE address this issue?

--Could this problem be minimized by a more gradual influx of DOE and contractor personnel into the area?

29. Bedded salt is not clean--there are layers of other rock present within it. How will this affect safety?

30. Are there vertical faults present in the bedded salt? How do you characterize them and how do they affect safety?

31. What are the potentially "fatal" flaws at Deaf Smith? Is your test program structured to answer these questions first, or at least, early on? If not, please explain why not? Would this be possible?

Hanford Site

32. What has been learned already about basalt through testing at the Near Surface Testing Facility at Hanford?

33. What are the most difficult technical problems to answer in order to get a license for a repository in Hanford basalt? Is your testing program structured to deal with these issues early in the process?

34. Is it possible to make calculations of groundwater travel time with a high degree of certainty?

35. How will you answer questions on the vertical movement of water?

36. How and where does water at the repository depth communicate with the Columbia River?

37. Basalt is very hard and will be quite hot at repository depth. Does the difficulty of mining and construction in basalt make the site less attractive?

38. What is the distance from the Cohasset Flow to more porous layers? Please comment on how water in the basalt flow will communicate with the adjacent layers of rock.

39. At Hanford, cost is much higher. Why?

--Please provide the most recent estimates for the cost of site characterization, and for the cost of construction of a repository.

Grant Funding

40. Grant funding given to states for independent review has been a continual bone of contention between DOE and the states.

--When do the states send requests to DOE?

--Are requests frequently received after the Department's overall budget to Congress has been formulated?

--Can these grant requests be easily factored into the Department's overall budget request?

--In order to honor the states' grant requests, do the field offices ever have to dip into their own budget?

State Participation

41. There is currently an on-site representative from the Nez Perce Indian Tribe at the Hanford reservation.

--Are there plans for having on-site representatives from the other Indian tribes or the state?

--Do on-site representatives have full access to DOE officials and contractor personnel?

--Are there state representatives on-site at Yucca Mountain? Or are there plans for this in the future?

J BENNETT JOHNSTON LOUISIANA, CHAIRMAN

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United States Senate

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
WASHINGTON, DC 20510-6150

June 30, 1987

The Honorable Ben C. Rusche
Director, Office of Civilian
  Radioactive Waste Management
U.S. Department of Energy
Washington, D.C. 20585

Dear Mr. Rusche:

I want to thank your office for providing witnesses to appear before the Committee on Energy and Natural Resources on June 29, 1987 to discuss the Department of Energy's nuclear waste geologic siting process.

As a follow-up to that hearing, I have attached questions from myself and Senator McClure to be included in the printed hearing record. I would appreciate your response to these questions by close of business July 10, 1987 so as to expedite the printing of this document. If you have any questions, please contact Mary Louise Wagner at (202) 224-7569.

Thank you again for your continued interest and I look forward to working closely with you in the future.

With kindest personal regards,

Extension granted until 7/24.
MK

Sincerely,

J. Bennett Johnston
Chairman

JBJ:tc

POST-HEARING QUESTIONS AND ANSWERS RELATING TO THE JUNE 29, 1987, HEARING

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

WITNESSES:

John H. Anttonen
Project Manager
Basalt Waste Isolation Project
Richland Operations Office

Stephen H. Kale
Associate Director
Office of Geologic Repositories
OCRWM

Jeff O. Neff
Project Manager
Salt Repository Project Office

Donald L. Vieth
Director
Waste Management Project Office
Nevada Operations Office

QUESTIONS FROM SENATOR McCLURE

QUESTION 1: (to Stephen Kale, DOE-HQ) There has been a lot of interest in and speculation about the recently announced solicitation for the "Super-Integrator" (real name: "System Engineering, Development, and Management") contract, which, as I understand it, would involve the selection of a contractor to oversee and coordinate all aspects of the high-level waste program.

a) Could you elaborate on the responsibilities to be assigned to the "Super-Integrator?"

b) What kind of qualifications and expertise will be considered in the selection of this contractor?

c) If a contractor is selected who already has work under the program, how will conflict of interest be dealt with?

d) What is the schedule for final selection?

ANSWER: At a presolicitation conference held by DOE on June 16, 1987, information concerning questions a), c), and d) was made available to the public. The information is enclosed in response to these three questions. Information regarding selection qualifications and expertise (question b) will be made available as part of the Request for Proposals; these are expected to be issued in August 1987.

QUESTIONS FROM SENATOR MCCLURE

QUESTION 2: I notice that, according to the testimony from the three site managers, Washington has received considerably more grant money ($23.8 million since 1983) than either Nevada ($15.3 million since 1983) or Texas ($2.5 million for FY 1987). Is there any reason for the differences? Is this a function of the States' requests, or are the grant amounts determined solely by DOE? Do you notice any better relationship with Washington as a result of the larger grants, which I assume translates to a higher interaction level?

ANSWER: The funds awarded by the Basalt Waste Isolation Project since 1983 include grant awards to:

State of Washington (about $9.6 million)
Washington State Legislature (about $1.4 million)
State of Oregon ($500,000)
Nez Perce Tribe (about $2.9 million)
Confederated Tribes and Bands of the Umatilla Indian Reservation (about $2.7 million)
Yakima Indian Tribe (about $5.6 million)

Since 1983, the State of Nevada has received about $15.3 million and the State of Texas has received about $4.6 million.

Differences in grant awards are based on what each State or Indian Tribe has requested and justified in its grant application.

There appears to be no correlation between level of grant award and state of relationship between DOE and the States and Indian Tribes.

QUESTIONS FROM SENATOR MCCLURE

QUESTION 3: It appears that the C&C (consultation and cooperation) negotiations are moving along at a snail's pace, if at all. Could you give us your impressions as to the reasons why the States are resisting this process?

ANSWER: Issues surrounding the negotiation of a C&C Agreement are difficult ones to resolve, and there are often competing interests at both the legislative and executive levels of State government on how to address these issues. It may be particularly difficult to consummate an agreement which deals with a wide range of issues at once. Incremental agreements, on the other hand, may be more practical. In its February 1987 report entitled, "Institutional Relations Under the Nuclear Waste Policy Act of 1982," the General Accounting Office recommended incremental agreements. DOE is currently considering the feasibility of such agreements.

Although no formal agreements have been signed between the Department and the States, a number of ongoing informal working agreements have been developed.

ANSWER 3 (cont'd)

In their response to the Department's initiatives to begin C&C negotiations, the States and Indian Tribes also stated other reasons for not entering into negotiations with the Department. The Governor of Washington State, for example, indicated that C&C negotiations cannot be successful until program credibility is restored. Governor Bryan of Nevada stated in a letter to Secretary Herrington that the Department's implementation of the Act has made it "impossible for the State of Nevada to have any confidence or trust in any negotiations with the Department regarding the implementation of the balance of the program. . ."

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) also expressed concerns about resuming C&C negotiations, indicating that they would not do so until the following conditions were met: (1) that DOE resolve the issue of whether Indian Tribes are eligible to develop an impact assessment report and receive impact mitigation assistance under Section 118(b); (2) that DOE and the CTUIR reach a timely and mutually satisfactory resolution of their FY87 grant proposal; and (3) that DOE recognize in writing that the Act is to be

ANSWER 3 (cont'd)

construed broadly so as to maximize the participatory rights of the CTUIR. The Nez Perce Indian Tribe likewise wrote to DOE to indicate that the Tribe's decision to enter into negotiations would depend on whether the Nez Perce would be eligible for impact assistance under Section 118(b) of the Act.

It should be noted that while no State has accepted the Department's invitation to begin C&C negotiations, the Nez Perce Indian Tribe requested in April 1987 that such negotiations commence. A meeting was held on June 11, 1987, to discuss the procedures that will govern the conduct of negotiations, and the next six negotiating sessions have been scheduled. The Department remains interested in beginning negotiations with all affected parties.

The Department had undertaken negotiations previously with the State of Washington and the Yakima Indian Nation at their request. Negotiations with the Yakima Indian Nation, which were suspended

ANSWER 3 (cont'd)

pending conclusion of an agreement with the State of Washington, were described in a report transmitted to Congress on September 26, 1984. Negotiations with the State of Washington were suspended by the State pending resolution of several issues. When the negotiations were suspended, DOE and the State had developed a preliminary draft covering 18 items under consideration. These negotiations were also described in the September 26, 1984, report to Congress. The Department had also held prior negotiations with the CTUIR. These negotiations were suspended by the CTUIR and reported to Congress in a report transmitted on March 17, 1986. In July 1986, DOE resumed negotiations with the CTUIR, again at their request. Subsequent negotiating sessions were held in August, October, and November 1986.

The status of the Department's efforts to enter into consultation and cooperation negotiations with all States and affected Indian Tribes were detailed in a May 26, 1987, report to Congress from Ben C. Rusche, Director of the Office of Civilian Radioactive Waste Management.

QUESTIONS FROM SENATOR MCCLURE

QUESTION 4a: Please elaborate on the Department's plan and schedule for land acquisition at the Deaf Smith, Texas, site.

4b: You mentioned land value in the agricultural area near Deaf Smith as being part of your study of socioeconomic impacts. Have you noticed any changes in land value to date?

4c: DOE is presently moving its offices to the Deaf Smith area, and this will result in a rather large influx of people (approximately 800), in a relatively short period of time, to a relatively low population area. Yet DOE says they can't identify any significant adverse impacts from this inmigration of workers. What about schools, housing, services, and the like? Will this area be able to absorb the influx easily?

ANSWER 4a: The Department's plan and schedule for land acquisition at the Deaf Smith, Texas, site is dependent upon completion of the Real Estate Planning Report (REPR) by the U.S. Army Corps of Engineers, and the Land Acquisition Plan (LAP) by the Department of Energy. The schedule for preparing the REPR has been delayed, and at this time I cannot provide a final schedule for release of the LAP.

ANSWER 4b: Changes in land values attributable to the DOE program have not yet been demonstrated. Statements are made to the effect that the program has caused a decline in land value, but requests for documentation or demonstration of this effect have not resulted in any being provided.

ANSWER 4b: (cont'd)

The Salt Repository Project Office plans to monitor land use changes, including residential settlements, that may occur in rural areas as a result of project activities. Because there are no zoning ordinances for these areas, uncertainty exists regarding likely new land uses. Given the uncertainties of project-related land use patterns, there may be differences in these uses and existing land uses that could be associated with changes in land values. Consequently, land use will be monitored to evaluate the potential for changes in land values.

Farmland prices across Texas are reportedly continuing on a downward trend, and may be bottoming. The U.S. Department of Agriculture (USDA) reports some stability in early 1987, although a report from the Texas Department of Agriculture says the general slide in values continues throughout Texas--median land values fell from $212 an acre in 1986 to $150 an acre this year. There was a 16 percent drop statewide last year, with the Panhandle probably having a somewhat larger drop. Data from the Federal Reserve Bank of Dallas indicate the northern High Plains region had a drop from $202 in 1981 to $131 in 1986 for

ANSWER 4b: (cont'd)

ranchland; $313 to $217 for dryland farms; and $675 to $399 for irrigated farmland for the same period. In summary, it is an accurate statement that farmland values are declining. Whether the DOE project contributes to this decline locally has not been demonstrated.

ANSWER 4c: DOE recognizes that a concentration of project workers in a small community has the potential of creating adverse impacts on the community services. However, there are also clear economic benefits associated with a project of this size and type that should be maximized where possible.

Consequently, there was a specific management decision made about office locations and the rate at which staff moves would occur in an effort to avoid significant adverse impacts and to maximize positive impacts. Project offices will be located in Hereford, Amarillo, Vega, and on the nine-square-mile site.

The Hereford office is the base of the DOE operations, and includes DOE, Battelle Memorial Institute, and a few small support contractor staffs. Parsons-Redpath, the construction manager

ANSWER 4c: (cont'd)

for the exploratory shafts, is also temporarily officed in Hereford until access to the exploratory shafts is obtained and construction is ready to commence. The staff complement in these Hereford offices will be 373 project workers. A projected 10-20 percent of these workers are expected to reside in Hereford (37-74 families); some of these will be families transferred from Ohio, others will be local residents hired for the project (to date 44% of the project staff have been hired from the local area). DOE, Battelle, Parsons-Redpath, and the support contracts have been in the process of transferring staff from offices in Columbus, Ohio.

The transfer rate is as follows (actual through June; projected through November):

March	12
April	6
May	18
June	21
July	30
August	46
September	53
October	55
November	35

ANSWER 4c: (cont'd)

This gradual transfer of workers over a nine month period enables DOE to continually assess whether unexpected adverse impacts are likely to develop, and if so to take mitigative action. Continual interactions occur with community leaders and representatives of local services. Data are compiled and shared weekly about where staff are choosing to reside and how many school age children are being added to a school system. In addition, the Department continually attempts to improve projections of how many staff are relocating, and where they might choose to live in an effort to understand the effect on the communities. We also collect and share data related to personnel hired from the local communities. The attached Deputy Manager's Briefing Notes include the type of information presented at a weekly public project status meeting in Hereford. Also attached is a letter from Jefferson O. Neff, Salt Repository Project Office Manager, to Phil Neidzieldski-Eichner, Executive Director of the Waste Deposit Impact Committee, which contains additional details about the relocations to the Panhandle.

Amarillo will be the site for another project contractor, the technical field services contract,

ANSWER 4c: (cont'd)

expected to be announced in July. This contractor is expected to have a staff level of about 700 at its peak, with about 40% of the workforce hired from the local area. Because it is Amarillo-based, most of the project workers are expected to reside in that community. However, the same relocation projections and monitoring system will be utilized as the contractor becomes established so as to understand whether unexpected adverse impacts might develop.

Vega will continue to be the location of a small visitors' center and information office with no significant staff build-up.

As preparations begin for construction of the Exploratory Shaft Facility in late 1989, Parsons-Redpath will begin staffing an office on the nine-square-mile site. Projections will be done to assess whether mitigative measures should be implemented to avoid adverse impacts to the nearest community, Vega. For example, workers could be bussed from Amarillo or Hereford to encourage settlement in communities that could better handle the influx of new people without straining available community services.

ANSWER 4c: (cont'd)

In summary, we are taking care to move DOE and contractor staff and their families gradually into the Panhandle, and to monitor settlement patterns to assess the potential for development of undesirable impacts. The impact of incoming people is not yet, and is not expected to be, a heavy burden to the affected communities.

DEPUTY MANAGER'S BRIEFING - 7-1-87

INTRODUCTION

The Deputy Manager's Briefing is to provide a status of the transition of the Salt Repository Project to Texas. These meetings are held every Wednesday morning at 7:00 a.m. in the Hereford Community Center. The public is invited. The information presented in these meetings will be of a routine nature. No policy announcements are planned.

The agenda will include the following items:

Staffing
Procurement
Topics of General Interest
Questions and Answers

We encourage follow-up on any issues or concerns. The DOE office phone number is 364-8920. The information Office in Hereford phone number is 364-0101.

A Staffing June 28, 1987

There are 94 Project Personnel in Texas as of June 28, 1987. This includes:

	No.	Percent	Over Last Week
DOE	19	20	0
Battelle	40	43	0
Parsons-Redpath	18	19	0
CER	7	7	1
SMS	3	3	1
MAXIMA	7	7	1
	94	100	2

Of these Project totals:

	No.	Percent	Over Last Week
Transfers	51	54	0
Local Hires	41	44	2
Non-local Hires	2	2	0
	94	100	2

* round-off error

These staff reside in:	#	%	over last week
Hereford	36	38	4
Canyon	6	6	0
Amarillo	33	35	(1)
Vega	2	2	0
Other/undecided	17	18	(1)
	94	100	2 net

Of the 36 Hereford staff members:

Fourteen (14) are Transfers for 39% of the total
Twenty-Two (22) are Local Hires for 61% of the total

For the 14 staff transfers to Hereford, there were 15 school age children added to the Hereford School System.

The 36 Hereford staff members, which includes both local hires and transfers, result in an annual estimated payroll of over $900.000.

Revised projections for the transitioning staff for the next several months are:

July	30
Aug.	46
Sept.	53
Oct.	55
Nov.	35

DOE and 5 Project Contractors are stationed in Hereford. The full complement of staff for each organization is:

Organization	Full FY87 Complement	# stationed in Hereford to date	% of Full Complement
DOE	42	19	45
Battelle	282	40	14
Parsons-Redpath	18	18	100
CER	16	7	44
SMS	5	3	60
MAXIMA	10	7	70
TOTAL	373	94	25

Of the 373, approximately 276 or 74% of existing staff are projected to transfer to the Project Office in Hereford.

B. PROCUREMENTS JUNE 28, 1987

Between mid-February, 1987 and June 28, 1987, the Salt Repository Staff have committed more than 1.5M in procurement actions. The distribution of these expenditures is as follows:

	Hereford	Amarillo	Vega	Other TX	Non TX	Total
Expenditures	566.6K	751.3K	47.7K	134.6K	5.2K	1505.4K
% of total	38%	50%	3.2%	8.9%	.3%	100%

This has an increase of 43.8K over last week's report. Hereford has received over $.5M which is over 1/3 of all Project funds committed by the Project Office in Texas.

An outstanding procurement is for permanent office space for Battelle which will result in leasing 64,000 square feet of office space in Hereford. The due date for proposals was June 10, 1987. A number of excellent proposals were received and were evaluated. Proposers were notified of their individual status last week. Negotiations with firms on the competitive "short list" are underway. Renovations for the selected buildings will be initiated after award.

This procurement will make Hereford the largest source of procurement commitments for the Texas Salt Repository Project.

No major procurements are planned in the near future.

C. TOPICS OF GENERAL INTEREST

1. Work continues on setting up a training session on Federal Procurements for local contractors. July 16, 1987 is the target date for this. This contracting workshop is to assist local vendors in becoming more effective competitors for federal procurements.

2. One Corps of Engineers (COE) representative is scheduled to be in Hereford next week to gather information on mineral values. This information will be used to assist in the preparation of the Real Estate Planning Report.

3. A luncheon presentation is scheduled today with the Amarillo Chamber of Commerce Small Business Council to discuss the Salt Repository Project.

4. Four summer temporary employees have been hired. They started this week. All four are from Hereford. They will assist in performing a number of functions until full time staff are transfered.

5. J. Neff, the Project Manager is expected to report to work in Hereford on July 13.

6. Two visitors from Germany are scheduled to visit the SRP Hereford Office on July 20, 1987. They are representatives of the Thyssen Mining Company and have come to the U.S. to attend a mining conference.

7. The Salt Repository Project Manager, J.O. Neff, appeared before the Senate Committee for Energy and Natural Resources this week in Washington. Copies of his testimony are available from the Project Office.

DISTRIBUTION:

J. Neff, SRPO
P. Van Loan, SRPO
T. Taylor, SRPO
L. McClain, SRPO
R. Lahoti, SRPO
G. Appel, SRPO
J. Treadwell, ONWI
B. Lincoln, ONWI
G. Loudder, ONWI
G. Stafford, P-R
E. Kay, RW-2
W. Probst, RW-252
D. Bray, AMPTM
C. Morrison, OCM
C. West, Rep. Combest's Office
P. Niedzielski-Eichner, WDIC
G. Rasp,NWPO
S. Frishman, TNWPO
V. Smith, Maxima
S. Foels, SMS
W. Murphy, CER
A. Handwerker, LC

Department of Energy
Salt Repository Project Office
110 North 25 Mile Avenue
Hereford, Texas 79045

June 25, 1987

Mr. Phil Neidzieldski-Eichner
Waste Deposit Impact Committee
P.O. Box 2277
Hereford, TX 79045

Dear Mr. Neidzieldski-Eichner:

SUBJECT: REQUEST TO MODERATE SRPO RELOCATION TO PANHANDLE

We have received your letter of June 19, 1987 requesting that the relocation of project personnel to the Panhandle be moderated. I would like to discuss in some detail our plans for relocation and also the specific recommendations described in the attachment to your letter.

In February, when the relocation was initiated, we announced that after the initial move of a small contingent to the Panhandle, we anticipated that about 50 people a month would relocate beginning in April. The actual number of relocating families has been smaller than projected, and includes the following:

March	12
April	6
May	18
June	21
Total	57

Of these staff who have moved from Ohio, 13 are residents of Hereford. An additional 19 people who already resided in Hereford have been hired on the project. We are forecasting the following relocations for the next five months:

July	30
August	46
September	53
October	55
November	35

It is not possible to accurately predict how the staff will be distributed because the largest majority to still move are Battelle staff, many of whom have not yet been to the Panhandle.

These figures also assume all Battelle staff choose to relocate. The results of an earlier survey of residence preferences for these staff indicate about 10% represent Hereford as their first residence choice. To date, the thirteen families who have moved to Hereford represent 24% of the relocated staff. From the predictions, and the actual settlement patterns to date, we would estimate 10-20% of the project staff will reside in Hereford (37-74 families).

In order to assist in local planning we will collect data about family size, number and ages of school children, and housing preferences for those chosing Hereford as their home. These data will be made available to you and the school system as they are compiled.

Specific Recommendation of the WDIC.

1. Firm establishment of the State NWPO and WDIC socioeconomic assessment programs is desired in order to document baseline conditions. We would suggest that early work be concentrated on services of prime concern, and results be discussed with DOE staff as early as possible. It is my understanding that the NWPO and WDIC study is to be completed by the end of July, and we would welcome opportunities to discuss progress on the study as data are compiled, especially if tangible issues develop.

2. DOE is requested to complete its assessment of impacts based on workforce size as revised from the original EA. The workforce size projected between now and November is within the bounds of that discussed in the Environmental Assessment. Certain management decisions have been made about location of staff offices since the publication of the EAs; before initiating the relocation in February, a verbal verification was done to reassure that community services were adequate to absorb the influx of new residents. The gravity model used in the EA has been rerun with new staff levels and office locations, although in terms of predicting actual distribution of workers it has little utility. The principal use of the model was in comparing one site to another.

3. It is hoped that funds will be appropriated and designated by Congress for mitigation of documented tangible impacts. DOE is working in parallel with the WDIC to attempt to secure Congressional funding for local areas in the event there are such impacts. However, our analyses of community service capacities indicate that the relocation of the staff do not overburden the available services. We also feel it is important to complete the project move from both a management perspective and from consideration of the difficult personal burdens placed on staff when additional uncertainties are introduced.

4. The WDIC wishes to have established land acquisition policy positions given Legislative consideration. This activity is independent of the project relocation; we would be pleased to discuss with you the policy positions adopted by the WDIC in light of Federal land acquisition requirements.

5. The WDIC wishes to establish principles and procedures for interaction between SRPO and the WDIC. We also believe that this issue is independent of the project relocation. We welcome the opportunity to enter into these discussions. In the interim, my staff will continue to provide information to the Committee and will be available to discuss any issue of concern.

6. The WDIC desires that programs be installed to offset negative impacts incurred by increased competition for the limited labor supply. We would suggest that contrary to having a limited labor supply in the area, the reverse seems to be the case. There is an extremely high response to posted project positions, and ample numbers of qualified applicants within those responding.

7. The WDIC desires that a program be establised to assist local vendors in becoming effective competitors for federal procurements. We have developed a contracting workshop for Hereford businesses, to be held on July 16, as a first step in assisting area businesses in successfully competing for project procurements. We welcome opportunities to discuss additional means to assist in this area.

In summary, we are pursuing a "moderate" path of relocating staff to the area. To date the tangible impacts to the Hereford area have been positive; and there have been no demonstrable negative impacts identified. Staff have been given relocation dates, and are progressing with their personal plans to move. The management inefficiencies of having two offices also result in our desire to conclude the relocations on a reasonable time frame.

I commit to continuing to work with you and the committee as the moves progress and look forward to discussing results of your socioeconomic studies as they might affect or be affected by our project, and I remain committed to work with you to mitigate any tangible negative impact to the community. Please feel free to call me at any time.

Sincerely,

J.O. Neff
Project Manager
Salt Repository Project Office

SRPO:LKM:kgh

cc: S. Frishman, TX NWPO
W. Probst, RW-223
T. Moore, WDIC Chairman

167-87-OMTX

QUESTIONS FROM SENATOR MCCLURE

QUESTION 5: I understand that the Nevada State Legislature recently passed legislation creating a new county--"Bullfrog County"--in the area in which Yucca Mountain is located. What effect will this have on the high-level waste program? What do you think was the purpose of this legislation? How will this effect Nye County residents, State revenues (payments-equal-to-taxes), local revenues, grants, etc.?

ANSWER: DOE is not currently aware of significant effects on the high-level waste program as a result of the creation of Bullfrog County and likewise it is unclear at this time what the effect will be on Nye County.

The Nuclear Waste Policy Act of 1982 provides that payments-equal-to-taxes (PETT) be provided to each State and unit of general local government in which a site for a repository is approved for site characterization.

Since the Yucca Mountain site is now in Bullfrog County and not Nye County, then the Department expects that Bullfrog County will be the recipient of PETT payments instead of Nye County.

QUESTIONS FROM SENATOR MCCLURE

QUESTION 6: The Nuclear Waste Policy Act provides a number of means by which affected States, localities, and Indian Tribes can participate in the waste program, obtain financial and technical assistance, and provide input into various decision documents. However, new ideas are surfacing all the time on additional ways to enhance the States' role, not the least of which is S. 839--the Incentive Package Bill that Senator Johnston and I introduced earlier this year. Since you people are closest to the actual interactions with the States and local governments, perhaps you could give us suggestions on how to improve the process (definition of "local units of government," proportionment of grants between States and local governments, impact aid during site characterization phase, etc.).

ANSWER: The Department offers the following suggestions on how to improve the process by which affected States, localities and Indian Tribes can participate in the waste program, obtain financial and technical assistance, and provide input into various decision documents: (1) authorize funds appropriated pursuant to the Nuclear Waste Policy Act of 1982 to be used to provide payments-equal-to-taxes to special purpose units of local government at the candidate site; (2) authorize the Department to provide grants directly to affected local governments; (3) authorize the Department to provide financial and technical impact mitigation assistance directly to local governments; and (4) authorize the Department to provide financial and technical impact mitigation assistance to affected States, local governments, and Indian Tribes during the site characterization phase.

QUESTIONS FROM SENATOR McCLURE

QUESTION 7: All of us here are concerned about the tremendous costs associated with site characterization as planned by the Department. While I would be first to agree with the Department that thorough scientific studies at these sites is essential in order to demonstrate the site's suitability (or unsuitability) for the waste repository, I wonder whether there might be a way to proceed that would allow the least expensive testing to be done first, so that if these tests result in disqualification of the site, further, more expensive testing (such as shaft sinking) would be avoided. Let's assume that schedule is not a consideration. Do you have any suggestions as to a logical sequence of testing that could result in cost-saving?

ANSWER: As part of our site characterization program, we have evaluated the sequence of testing, and where appropriate, have elected to perform surface-based testing first. For example, at the Hanford site, we have initiated a major surface-based program directed toward obtaining information related to site hydrology, a critical site parameter. This program is structured to gather needed data before initiating construction of the exploratory shafts. This program is also designed to focus on any data anomaly which suggests a potential disqualifying condition exists. Thus, at the Hanford site, an extensive surface-based program is underway which is aimed at gathering key information related to site hydrology and, if data suggests the existence of potential site disqualifiers, the program is refocused to resolve the issue.

ANSWER 7: (cont'd)

At the Deaf Smith site, a similar site hydrology program is planned prior to start of exploratory shaft construction. Although our planning activities for surface-based testing are not as mature as at the Hanford site, we intend to gather as much critical information as needed to assess the suitability of the site for continued characterization. If a site disqualifying condition exists which can be identified from the surface, we expect the surface-based program will identify its existence.

Finally, at the Yucca Mountain site, the situation is somewhat different. Although we agree that there are a number of issues that can be addressed by surface-based testing, underground testing is required to reach a sound understanding of the hydrology, as well as examination of deep faults. Further, since both test programs, surface-based and underground, can proceed relatively independent of one another and information is needed from both to examine the potential disqualifying factors, the DOE believes that underground testing should not be deferred in favor of surface-based testing.

QUESTIONS FROM SENATOR MCCLURE

QUESTION 8: Several proposals are floating around Congress to halt all work on the first repository sites while an "independent panel" of some sort reviews the genesis of the entire high-level waste program to date. Some of these proposals even suggest that a new, nation-wide search be undertaken. What is your feeling about the merits of such a proposal? What would this moratorium do to the work now in progress at your sites? Do you think that any State, under any circumstance, no matter how "clean" and unbiased the selection, would react any more favorably to the prospects of hosting a high-level waste repository than the three States we are now dealing with?

ANSWER: A new, nation-wide search for potential repository sites would very significantly affect the time when a geologic repository would be available for disposal of spent fuel and high-level waste. DOE continues to believe that each of the three sites selected for characterization for the first repository will be found suitable. Because of this, DOE firmly believes the country does not need to experience the delay that would result from a new nation-wide search for potential sites. Any such delay will have substantial negative impact in our ability to solve the waste management issues, and will certainly have, at a minimum, great impacts on ultimate costs and schedules.

A moratorium on the work now in progress would essentially stop the characterization of the sites.

ANSWER 8: (cont'd)

The momentum of the program will be halted, key personnel can be expected to leave the program, restart will take years to reach the point of suspension, and great uncertainties will likely override future program considerations.

At this point, it appears to be difficult for any State to react favorably to being selected to host a geologic repository for spent fuel and high-level waste. Reactions by both first and second repository candidate States underscore the State reactions. Incentives that the Federal Government would agree to provide the host State could possibly help to reverse this situation.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 1:	What are considered the major advantages of each rock type?
ANSWER:	A fairly detailed discussion of the major advantages and disadvantages of the potential host rocks for the first repository is contained in Section 5.7 of Part II, Volume I of the Mission Plan for the Civilian Radioactive Waste Management Program (June 1985). The material that follows is abstracted from that section of the Mission Plan. The attached table (Table 5-4) lists advantages and disadvantages that are generic to domal and bedded salts, but specific to the Hanford site basalts and Yucca Mountain tuffs. It is evident that no rock type is clearly superior. The suitability of any of these rocks can only be judged by analyzing all of the intrinsic advantages and disadvantages -- as influenced by the conditions prevalent at a specific site -- and by analyzing the performance of the total isolation system. Detailed site-specific investigations are required to establish the ultimate suitability of any potential site in any of the potential host rocks for the location of a repository.

Table 5-4. General Comparison of the Potential Host Rocks for the First Repository[a]

Advantages	Disadvantages
BASALT (HANFORD SITE)	
Very strong rock Low permeability at depth due to secondary minerals in fractures Minerals that fill fractures and minerals that will form by chemical reactions during thermal pulse are commonly highly sorptive Characterized by geochemical conditions that generally inhibit radionuclide transport No resource potential of the rock	Complex hydrology very difficult to characterize and model Variations in lateral and vertical extent and properties make it difficult to characterize and model Reduced mechanical stability due to fracturing Relatively expensive to excavate Some layers have high permeability at shallow depth where they constitute aquifers Unknown resource potential in deep underlying rocks
BEDDED SALT AND SALT DOMES	
Very low water content Very low permeability High thermal conductivity Deforms by plastic flow rather than fracture; fractures tend to self-heal Low cost of excavation Bedded salt is relatively easy to characterize and model Extensive mining experience	Natural resources (other than salt) are commonly associated with salt deposits; these include potash in bedded salt and sulfur, oil, and gas near salt domes Highly soluble in water; extent and rate of dissolution difficult to characterize Creep closure of mined openings complicates modeling Likelihood of pockets of gas or brine Low sorptive capacity Salt domes are relatively difficult to characterize and model Highly corrosive to metal
TUFFS (YUCCA MOUNTAIN SITE)	
Virtually no mineral or energy resource potential Highly sorptive minerals constitute large proportion of many beds Very low flux of water in arid regions Present in significant thicknesses above the water table	Because composition and physical properties are highly variable, strata are relatively difficult to characterize and model Reduced mechanical stability because of fracturing Aquifers in arid regions may be attractive to future generations Unsaturated zone hydrology not well understood and difficult to characterize and model Seismic activity tends to be high in regions where tuffs occur

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[a] The information contained in this table is a summary based on Section 5. See also Section 5.7.4 for a brief discussion of the perspectives from which these advantages and disadvantages are to be viewed.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 2: When will each site project be physically ready to drill the exploratory shaft? Do these estimates include time allowance for permitting, land acquisition, etc?

ANSWER: As shown in Table 1 of the OCRWM Mission Plan Amendment issued June 1987, the start of exploratory shaft construction is scheduled to begin in the fourth quarter of (calendar year) 1988 for the tuff project, the second quarter of 1989 for the basalt project, and the fourth quarter of 1989 for the salt project. These dates include success-oriented time allowances for permitting, land acquisition, etc. More details on the basis for determining these dates can be found in Appendix B of the Mission Plan Amendment.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 3: What types of permits will be necessary at each site to drill exploratory shafts?

ANSWER: Like any large-scale Federal construction activity, there are a number of permitting requirements that could potentially be triggered by Federal environmental statutes. For example: 1) the Clean Air Act (Air Pollution Permit), 2) the Resource Conservation and Recovery Act (Subtitle C--Hazardous Waste Permit, Subtitle D--Solid Waste Permit), and 3) The Clean Water Act (NPDES Permit). The DOE is currently in the process, through the development of site-specific environmental regulatory compliance plans, of establishing the specific permitting requirements of each of these statutes in order to carry out site characterization.

It is DOE's policy to comply with State and local regulations as a matter of comity, provided that such regulations do not prevent the Department from fulfilling its responsibilities under the NWPA.

In the process of developing Environmental Regulatory Compliance Plans for the three sites selected for characterization, DOE will delineate permitting requirements under applicable Federal laws, as well as State and local statutes that are not

ANSWER 3: (cont'd)

inconsistent with the mandates of the Nuclear Waste Policy Act of 1982. These plans will provide a basis for full and open consultation with the host States, as well as facilitate DOE's efforts to complete the site characterization phase in a timely and environmentally sensitive manner.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 4: Approximately how much of the data necessary to evaluate site suitability can be obtained by surface testing prior to sinking the exploratory shafts?

ANSWER: We are unable to provide a definitive answer to this question now since the site characterization plans (SCPs) are currently under development. These plans will provide a basis for a complete reply. The SCPs for Yucca Mountain and Hanford are scheduled for issue this fall. The Salt SCP is scheduled for issue in the spring of 1988.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 5: The NRC staff has stated that it may be possible to obtain conclusive data for some of the potentially disqualifying factors by surface-based testing prior to drilling an exploratory shaft.

a. Does DOE agree with that?

b. What technical issues at each site might be able to be resolved through surface testing?

c. Is the Department's program structured to address these issues prior to sinking exploratory shafts?

d. Will DOE have to restructure its test program for fiscal year 1988 if there is a moratorium on exploratory shaft drilling?

ANSWER a: The Department agrees that a significant amount of data related to disqualifying factors can be obtained through surface-based testing, and that the potential presence of such factors may be detected through such testing. However, the Department believes that in many cases the presence of such disqualifying factors must be confirmed through underground testing. Our response to Question 7 from Senator McClure provides more details on this issue.

ANSWER b: The primary technical issues that can be resolved through surface-based testing include dissolution, erosion, regional and global climate, and potential for human intrusion at all three candidate sites. An additional technical issue for which surface-based testing will play an important role is the time of ground water travel from the repository

ANSWER 5b: (cont'd)

horizon to the accessible environment. At the Hanford site, surface-based large-scale hydrologic testing will provide information on vertical conductivity and on the spatial distribution of hydrologic properties. The testing is being conducted at this time to further define the hydrologic baseline and to preserve perishable data that could be altered by potential effects of shaft construction.

ANSWER c: The site characterization programs, as presented for each Project in a site-specific Site Characterization Plan, is focused around the resolution of a structured hierarchy of issues through a specified issue resolution strategy that includes both surface-based testing and exploratory shaft facility construction and testing. (See OGR/B-10, Issue Hierarchy for a Mined Geologic Disposal System, copy attached.) Since the issues noted in response to question (b)--with the exception of ground water travel time--are not critical concerns, they do not need to be resolved prior to sinking the shaft although testing will be underway on these issues and data developed as part of site suitability investigations.

ANSWER 5d: As discussed above, the Department has attempted to develop a testing program which requires both surface based and underground testing. In the event of a moratorium on exploratory shaft drilling, the Department would proceed with surface based and laboratory testing, while delaying underground testing. It should be noted, however, that underground testing is on the critical path for resolution of issues to be addressed in the license application.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 6: What physical work is now going on at each site?

ANSWER: No physical work is currently being conducted by the SRPO at the Deaf Smith site. On-site activities, such as environmental surveys, are expected to begin in C.Y. 1987 after land access agreements have been obtained.

Enclosed are the Basalt Waste Isolation Project's _Letter Report on Ongoing and Planned Activities_ and the Nevada Nuclear Waste Storage Investigation Project's _Summary of Ongoing and Planned Site Characterization Activities for the Candidate Site at Yucca Mountain, Nevada_. These reports were prepared to provide information to States, Indian Tribes, and the NRC on the status of site characterization activities ongoing at the Federal sites and the relation of such activities to the site characterization programs presented in the Site Characterization Plans. Copies of the reports have been distributed to affected first repository States and Indian Tribes and to the NRC, and have been placed in DOE public reading rooms and in State libraries.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 7: DOE issued stop work orders to contractors at the Hanford site and the Yucca Mountain site beginning in 1986 because of concerns about inadequate quality assurance programs.

- Please explain why the Department felt these stop work orders were necessary.
- What is the current status of QA programs at these sites?
- When does the Department anticipate all stop work orders will be lifted?

ANSWER: The stop work order at the Hanford Site was issued because of the lack of a documented management control system. A readiness review board was formed in July of 1986. Actions which needed to be taken were identified and documented and a readiness review report was completed in May of 1987 showing the status of these actions. The report included a recommendation to partially lift the stop work order so that the contractor could initiate the preparation of work packages.

Each work package will be individually reviewed and approved by DOE before stopped work can be resumed. The contractor is now preparing these work packages which describe the work to be performed and the quality controls to be applied. Work is expected to be resumed over the next few months.

Minor revisions to the QA Plan for Hanford are currently being made to incorporate comments

ANSWER 7: (cont'd)

received from the Nuclear Regulatory Commission (NRC). The revised Plan will be issued in a few months.

The stop work orders at the Yucca Mountain site were issued because of insufficient planning documentation and inappropriate quality level assignments. The Planning documents and quality level assignments are reviewed and approved by DOE for each work task before work is permitted to be resumed. A partial lifting has been effected for all participating organizations except one. The planning documentation is now largely complete and quality level assignments are also well under way. Much of the stopped work has already been resumed. Most of the remaining work will be resumed over the next few months. However, it is not possible, at this time, to establish a firm date for fully resuming all stopped work at Yucca Mountain.

Minor revisions to the QA Plan for Yucca Mountain are also underway to incorporate comments received from the NRC. Issuance of the revised Plan is imminent.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 8: The question was asked at the June 29 hearing: From a seismic standpoint, would there be more impact on casks placed in an underground repository than casks placed in surface storage?

ANSWER: No. From a seismic standpoint, there would be less impact on waste packages placed in an underground repository than casks placed in surface storage. Vibratory ground motion, such as that occurring during a seismic event, is dampened and attenuated significantly with depth. Historic mining experience has repeatedly documented instances where high-magnitude earthquakes causing extensive surface damage have occurred while being unnoticed by miners working underground.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 9: Is DOE looking seriously at using copper canisters or other especially long-lived canisters for use in tuff or basalt? If not, why not?

ANSWER: Yes, DOE is considering copper and copper-based alloys, as well as steel alloys and others, as possible container materials for use in a high-level radioactive waste repository. DOE is familiar with studies being conducted by the Swedish high-level waste storage program. Along similar lines, DOE is also evaluating these materials, which under certain environmental conditions have possible long-life characteristics.

Specifically, the basalt site at Hanford is considering three container materials including 90-10 copper nickel and oxygen-free high-conductivity copper as candidate materials. In addition, the Basalt Waste Isolation Project is evaluating different container concepts, focussing primarily on pure copper or copper alloy monoliths similar to the Swedish concept.

At the tuff site at Yucca Mountain, the Nevada Nuclear Waste Storage Investigations (NNWSI) office is planning to select materials for detailed study from among six possible alternatives. Included in these alternatives are oxygen-free high-conductivity copper, 70-30 copper nickel, and aluminum bronze.

ANSWER 9: (cont'd)

In addition, NNWSI is considering the use of a non-metallic ceramic liner as a possible long-lived barrier for waste isolation.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 10: How will you demonstrate to NRC that casks (waste packages) will last the required 300 years?

ANSWER: DOE is required under 10 CFR Part 60 to show that containment of radionuclides within the waste packages will be substantially complete for a period of from 300 to 1000 years after repository closure. DOE has developed comprehensive strategies, which include reference and alternative approaches, for demonstrating compliance with the substantially complete containment requirement. These strategies form the backbone of the detailed testing program planned during site characterization. This program includes characterization of the waste package environment and acquisition of data on the performance of waste package materials and designs under expected repository conditions.

The results of site characterization and laboratory testing will be used to formulate mathematical models that will support demonstrations that the waste packages will comply with NRC requirements. Waste packages will be conservatively designed to provide substantially complete containment for 1000 years (the upper limit of the NRC substantially complete containment requirement).

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 11: How will repository design and safety be affected if spent fuel is stored for 30, 40, or 50 years?

ANSWER: The longer spent fuel is aged, the lower the radiation and heat production from radioactive decay which can result in reduced shielding requirements and reduced thermal design constraints on the repository and waste package. In particular, the amount of spent fuel that can be disposed of in a unit area of underground repository space could be increased. Beyond 10 to 20 years, additional heat and radiation dissipation is relatively small. Based on the oldest-fuel-first approach for acceptance of spent fuel from the utilities and a repository start-up date of 2003 (draft Mission Plan Amendment), the age of spent fuel initially received at a repository will be up to about 35 years old and would gradually decrease in age as more fuel is accepted.

DOE currently believes there is not much incentive from an overall systems perspective to additionally age spent fuel beyond 10 to 20 years. The system will continue to be designed for flexibility in accepting fuels and will continually be evaluated for adjustments that can embrace performance, cost, and schedule.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 12: How will reprocessing affect the design and safety of a repository?

ANSWER: During reprocessing, the metal clad spent fuel assemblies are chopped and exposed to acid which dissolves most of the fuel. Liquid-liquid extraction of the fuel solution results in a process stream of thorium, uranium, and plutonium which can be recovered in a solid form, as well as a process stream of fission products and transuranic elements which can be converted to a vitrified waste form for geologic disposal. Other wastes are also generated during reprocessing. Some of the fuel constituents adhere to the cladding hulls, which together with other structural parts of the fuel assemblies, are themselves radioactive and constitute a waste category. During reprocessing, radioactive gases containing krypton-85 and iodine-129 among others are trapped and collected. An additional reprocessing waste which must be disposed of is the uranium which is not recycled and which is depleted in the fissile U-235 isotope.

Assuming for the purposes of this answer that only the fission product process stream is vitrified and prepared for deep geologic disposal, it may be possible to reduce the size of the repository

ANSWER 12: (cont'd)

somewhat, based on a number of assumptions. The glass waste form has a lower long-term heat generation than spent fuel which may allow closer spacing (pitch) of waste packages. However, assuming the glass waste package contains the fission product waste from a greater number of spent fuel assemblies than a spent fuel waste package, the glass waste package would have an initially greater short term heat generation which would constrain waste package pitch.

From a repository safety standpoint, there is little safety advantage for disposal of either waste form over the other.

U.S. policy with regard to reprocessing of spent fuel from power reactors is that it should be a private sector initiative. Because of the failure of previous attempts to establish a reprocessing capability in the United States, industry concern about licensing uncertainties and the potential for changes in Government policy, and the lack of near-term economic incentives, new industry initiatives on reprocessing appear unlikely for the next several years. For this reason, the effects of reprocessing on repository design have not been addressed in depth. However, since a small amount

QUESTION 12: (cont'd)

(640 metric tons) of reprocessed commercial high-level waste from the West Valley Demonstration Project and defense waste for the Savannah River DWPF will be emplaced in the first repository and the reprocessing of spent fuel may be undertaken at a later date, the repository designs currently have the capability to accommodate reprocessed waste and future designs will not preclude a later decision to dispose of such waste.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 13: How much of the $1 billion cost of site characterization is actually field work? How much of that is evaluation, documentation, administration, management?

ANSWER: We estimate that about 35% - 45%, depending on the site, of the cost of site characterization is related to actual field work. About 20% - 30% is related to evaluation, documentation, administration, and management. The remainder is related to such activities as waste package design and development, repository design, grants, and payment-equal-to-taxes.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 14: What do you think about NRC's detailed licensing criteria? Do you have a good handle on the standards that must be met? Is it difficult to develop a test program that you feel will be adequate to meet any questions that NRC might ask? Isn't it true that, to some extent, the criteria that must be met by DOE are still evolving?

ANSWER: The Nuclear Regulatory Commission (NRC) promulgated final procedural rules for the repository licensing process in 1981 and final technical rules in 1983. The procedural rules have been amended to conform with the NWPA. The Environmental Protection Agency (EPA) has promulgated final general environmental standards for disposal of high-level radioactive waste (HLW), which the NRC was in the process of incorporating into its rules when the United States Court of Appeals for the First Circuit vacated the EPA standards. While the First Circuit's decision naturally creates some uncertainty with respect to precisely what general environment standards will have to be met, the overall ultimate standard that must be met before a geologic repository can be constructed and HLW disposal can take place still remains; i.e., the standard of reasonable assurance of no unreasonable risk to the public health and safety. Thus, NRC's regulations continue to provide adequate guidance for DOE to proceed with this stage of repository development. The requirements in the regulations are, for the most

ANSWER 14: (cont'd)

part, clear and understandable. While there are some ambiguities, these are being addressed as necessary. Once, of course, EPA has remedied the deficiencies the First Circuit found in the general environmental standards, the associated uncertainties will be removed.

The regulations, however, do not prescribe a method for disposal or for showing compliance with the regulations. The implementation of a disposal system has, properly, been left to DOE. In establishing the regulations, NRC left DOE with considerable flexibility even though it chose to require multiple barriers and specific performance objectives for those barriers in addition to requiring that overall performance meet the EPA standard.

The NRC barrier performance objectives alone are not intended to demonstrate compliance with the EPA overall standards but are intended to provide additional confidence of compliance in the face of acknowledged uncertainties.

The NWPA requires that the NRC regulations include the multiple barrier concept (Section

ANSWER 14: (cont'd)

121(b)(1)(B)). While the objectives for these barriers do represent somewhat detailed criteria which must be met, the NRC made specific provisions for modifying the numerical values without requiring an exemption from the regulation 10 CFR Part 60.113 (b).

The DOE program is an ongoing effort which is developing strategies for licensing as site data becomes available. As other site characterization and accompanying performances assessment efforts evolve, there is a need for NRC interpretations as to how they would apply the regulations to specific evaluations, techniques, or designs being considered by DOE. Thus we expect to have a continuing dialogue with NRC regarding the regulatory requirements which will be more extensive than the efforts to resolve initial ambiguities.

DOE plans to thoroughly investigate the sites to make long term predictions of site performance with sufficient confidence to satisfy the extensive burden of proof placed upon a licensee before the NRC. This is a difficult task. We believe, however, that when our program is completed

ANSWER 14: (cont'd)

answers to all questions necessary to demonstrate regulatory compliance with the required degree of certainty will be available.

The regulations acknowledged that it is neither possible nor necessary to run tests representing every imaginable scenario.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 15:	Is the cost of your test program impacted significantly by the cost of licensing and preparation for licensing?
ANSWER:	The burden of proof required of a licensee applicant in the nuclear licensing process employed in the United States does usually result in a costly testing program. The potential for high costs associated with testing to develop data for use in the licensing of the geologic repository is complicated by the fact that there is no prior experience in implementing the principal NRC regulation, 10 CFR Part 60. There is also little precedent to guide either the applicant (DOE), the regulator, or the many other parties that will participate in the numerous opportunities for litigation that exist in the nuclear licensing process. Similarly, the efforts required to prepare and disseminate the voluminous documentation required by the licensing process will add significant costs to the repository program. Other significant costs will accrue from the efforts necessary to prepare for and participate in the numerous public meetings and hearings required as a normal part of the licensing process. The Department believes the process is cost effective to give both NRC and the public the confidence needed to accept a high-level waste repository.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 16: Doesn't NRC's criteria actually in some ways limit the options available to DOE, such as reliance on multiple engineered barriers? Why wouldn't long-lived canisters help with licensing?

ANSWER: NRC regulations require that both the natural site and technology contribute to isolation of the wastes disposed in a geologic repository.

The ability of a nuclear waste repository to isolate radioactivity from the biosphere depends on the performance of the total system of both engineered and natural barriers. Within such a system, the performance appropriate for any particular barrier depends on other design features and site characteristics. In allocating performance to any particular component, the objective should be to optimize the performance of the total system to maximize isolation of waste. A long-lived waste package would, obviously, increase confidence in the degree of waste isolation over a less long-lived waste package. Thus, given current performance objectives in the NRC regulations, a long-lived waste package would help with licensing, provided that the longevity can be demonstrated adequately in the licensing forum. Care must be taken, however, that the consideration of a long-lived waste package not inadvertently shift the focus of site characterization away from

ANSWER 16: (cont'd)

finding a site with better isolation characteristics as opposed to one providing a more favorable waste package environment. Furthermore, this improvement in ease of licensing would have to be weighed against any increase in overall costs, which do not substantially enhance the public health and safety.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 17: Will the presence of faults and potential for fault movement affect the safety of a repository?

ANSWER: The question of repository safety related to fault movements is really one of predicting the damage that can be done by an earthquake during either pre-closure operations or during the 10,000 year post-closure timeframe. This evaluation has to be considered in light of several basic concepts: how often movement has occurred along faults in the vicinity of the repository, how much fault movement has occurred during a given earthquake, and what is the approximate magnitude of the worst earthquake that has occurred in the past.

Fault studies suggest that the likely movement that would occur in an average earthquake is between 4 and 24 inches; such an earthquake would have a probable magnitude of less than 6 1/2 on the Richter scale. Earthquakes of this type are not expected to produce conditions that cannot be accommodated by proper design and selection of building locations during the pre-closure period. In the post-closure period, this type of faulting (which has occurred during the last 1 million years) is not expected to cause significant changes in the hydrologic characteristics of the site that would affect release rates. The direct effects of

ANSWER 17: (cont'd)

faulting through the repository, if it should occur, would affect a small number of waste packages and is not expected to significantly affect release rates.

These estimates indicate that earthquake motion represents a concern that should be investigated further during site characterization activities. However, at present the concern over earthquake safety is not one which, in the opinion of DOE, should disqualify any of the three recommended sites from further site characterization.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 18: Suppose a new fault develops in the planned repository block. How will that affect the safety of a repository during construction and operation? After closure?

ANSWER: Faults develop in a given rock mass, such as Yucca Mountain, in response to the pressure created in the earth's crust by movements of material in the earth's mantle. This pressure, called the stress field, develops slowly and is stable over a very long period of time, on the order of millions of years. Once a fault develops in response to a given stress field, it remains the easiest route along which the crust can respond to continuing stress; development of new faults in a stable stress field is a very unlikely event, as existing faults will move before a new break in the crust can be created. The stress field that has created the faults seen at Yucca Mountain has been relatively stable for at least the last 12 million years. A change in this field would only occur over a long period of time, again on the order of millions of years; therefore, the likelihood of a new fault developing during either the 100 years of pre-closure repository operations or the 10,000 years of post-closure isolation is anticipated to be very low.

The unlikely event of a new fault developing, however, represents a design and performance

ANSWER 18: (cont'd)

concern no different than considering the likely effect of movement on an existing fault. The two "worst-case" scenarios are a shearing and subsequent breaching of the waste canisters in less than 1,000 years, or possible changes in hydrologic conditions that would result in waste being released to the accessible environment in less than 10,000 years. In order for faulting to breach a waste canister, movement on the fault would have to be greater than 3 inches, the width of the air space between the canister and the whole wall. Studies by the USGS indicate that such a movement occurs on the larger, existing faults outside the repository block at intervals greater than 7,500 years. The much smaller faults that are known to penetrate the repository block would have an extremely low probability of generating the movement required to breach the waste packages. There is no scientifically valid reason to believe that any new faults which may form within the next 1,000 years will be capable of greater movement.

Changes in the hydrologic characteristics during the 10,000 year post-closure timeframe that could be significant include changes in water table levels or changes in the properties of the rock units that will allow a significantly higher flux rate of

ANSWER 18: (cont'd)

water through the repository area, leading to a significantly shorter ground water travel time (GWTT). The effect on these parameters of the most likely fault movement is anticipated to be minor. However, much of the site characterization program to be carried out by the USGS and Sandia National Laboratories (SNL) is designed to answering these questions.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 19: On page 9 of your statement, you say that fault movement is far more significant for surface facilities than for subsurface facilities. Why is that?

- Does that mean that fault movement is more of an issue during construction and operation of a repository than it is for the 10,000 years after the repository is closed?

ANSWER: Damage from fault motion is generally caused by vibrations set up in surface structures by ground waves that are generated at the point of motion along the fault. The severity of the damage is in part caused by the fact that a structure such as a building has a free surface, i.e., a roof and walls, that can vibrate freely without being damped in any way. By contrast, the underground repository workings will have no free surface, and vibrations within the rock mass will generally be less intense underground than at the surface. An example of this can be seen at the Nevada Test Site, where tunnels in which nuclear tests are conducted regularly undergo accelerations more than 100 times greater than surface structures without significant damage.

Yes, fault movement is more of a concern during construction and operation than after the repository is closed; however, the probability of earthquakes in a pre-closure timeframe is low. In any case, surface facilities are being designed

ANSWER 19: (cont'd)

to handle reasonably expected earthquakes, and the surface facilities are being located in an area where the density of known Quaternary faults is very low. As stated above, the "worst-case" scenario for post-closure fault movement would be an event or set of events that could result in changes in hydrologic conditions that would result in waste being released to the accessible environment in less than 10,000 years. Changes in the hydrologic characteristics during the 10,000 year post-closure timeframe that could be significant include changes in water table levels or changes in the properties of the rock units that will allow a significantly higher flux rate of water through the repository area, leading to a significantly shorter GWTT. The potential effects of the anticipated range of fault movement on these parameters is anticipated to be minor.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 20: Volcanic rock is abundant in the area, such as the cinder cones near Yucca Mountain. Is this an indication of active volcanism?

- How will issues related to volcanism be resolved for licensing?

ANSWER: Not necessarily. A determination of whether an area has active volcanism is based not only on the presence of volcanic rocks, but also on factors such as the recurrence interval of volcanic eruptions. The existence of local evidence of increased heat flow such as abundant hot springs that would indicate that there is a significant body of melted rock (magma) at depth that is releasing heat into the upper part of the crust. The volcanic rocks at Yucca Mountain fall into two broad categories: the rocks associated with, and erupted from, the Timber Mountain volcanic center to the north of Yucca Mountain, and the small cinder cones that are found in the region around Yucca Mountain.

The volcanic rocks associated with the Timber Mountain center were erupted approximately 9 million years ago in a series of individual, volumetrically-large eruptions. The absence of presently active hot springs, an indication of a hot water (hydrothermal) plumbing system that typically develops over a large cooling body of magma, indicates that the magma body that produced

ANSWER 20: (cont'd)

these rocks has long since cooled and presents no further problem in terms of hazards to the repository. The small cinder cones that are found in the region around Yucca Mountain represent the eruption of relatively small batches of magma that are widely spaced in time and location. Research work by Los Alamos National Laboratory (LANL) indicates that the recurrence interval of these eruptions is on the order of 150,000 years or greater, making it highly unlikely that an eruption will recur on a timeframe that will threaten the waste isolation capabilities of the repository. In addition, preliminary work on the chemical signature of the rocks erupted from these volcanos indicates that the magmabodies were generated in the upper mantle, and interaction with crystal rocks is low; subsequent development of hydrothermal systems is therefore unlikely.

Additional work is planned by LANL volcanologists during site characterization to further refine the data on the recurrence intervals between individual eruptions, and to determine the chemical signature of the erupted rocks. These studies will refine

ANSWER 20: (cont'd)

our understanding of the likelihood of continued volcanic activity in the next 10,000 years, and of developing a significant hydrothermal system associated with a cooling magma body.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 21: Very little is known about the rate of groundwater flow in the unsaturated zone. DOE has expressed the view that the flow time to the accessible environment is greater than 20,000 years. The State of Nevada, however, says the flow time varies from less than 1,000 years to greater than 34,000 years.

ANSWER: DOE does not agree that very little is presently known about ground water flow in the unsaturated zone. The investigations carried out during pre-site characterization investigations were sufficiently detailed to allow rough scoping calculations that were sufficient for the level of detail required for the Environmental Assessment. At present, the State of Nevada has not indicated to DOE what model it used to reach the cited range in ground water travel times (GWTT); consequently, it is not possible at this time to evaluate the scientific validity of the State's range of values. The model used by NNWSI to derive the greater than 20,000 year travel time was developed by SNL and was designed to provide conservative values, i.e., unrealistically short travel times. It is important to emphasize that this model is preliminary and, at this stage, was utilized solely to aid the decision-making process used to decide if the Yucca Mountain site warrants site characterization. The GWTT values derived at this point in no way constitute the final project value for GWTT.

ANSWER 21: (cont'd)

Collection of extensive additional field and laboratory data is planned for site characterization in order to refine these calculations. As the data base used in these calculations is expanded during site characterization, the precision of the models used to evaluate GWTT for licensing will also be expanded to refine further these calculations.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 22: How long would it take for groundwater under the site to travel to an area of discharge into Amargosa Springs?

- How will DOE resolve this issue for licensing?

ANSWER: At present, there does not appear to be an "Amargosa Springs" on the available maps of the Amargosa Desert, so it is difficult to come up with a precise number. Estimates of the saturated zone portion of the GWTT based on conservative estimates of rock mass properties indicate that the saturated zone GWTT to the boundary of the accessible environment range (3 miles horizontal distance from the repository block) from 170-1700 years. The town of Amargosa Valley is greater than 9 miles down gradient from the repository area; rough estimates of the saturated zone GWTT range from 500 to 5100 years. The nearest point of natural surface discharge of ground water is at Ash Tree Spring, 20 miles from the repository area. Rough calculation of saturated zone GWTT to this discharge point is 1,000 to 10,000 years.

These calculations do not take into account the time required for ground water to move through the unsaturated zone to the water table. Preliminary estimates of unsaturated zone GWTT are significantly greater than saturated zone GWTT, and

ANSWER 22: (cont'd)

preliminary calculations indicate that it would take in excess of 20,000 years for water to move from the repository through the unsaturated zone to the water table directly below the repository.

At present, numerous studies are proposed that either will provide data for use in calculations of GWTT, or will constrain various models used to calculate GWTT. It is recognized by DOE that this single issue is extremely important, and priority will be placed during site characterization on establishing accurate and scientifically acceptable models for calculation of GWTT.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 23: The potential site is located under a major underground aquifer.

- -- What are the risks of contamination of the aquifer during construction? During operation, or after closure?
- -- What would be done to assure that this does not become a problem?
- -- How will you demonstrate solutions to this potential problem for licensing purposes?
- -- How does this risk influence the testing program?

ANSWER: During construction, no radioactive waste is planned to be emplaced in the repository and no radioactive contamination is possible. However, potential pathways for post closure contaminant transport, such as aquifers and shafts, would be monitored to assure that they are detected. During operation, this monitoring would continue and the behavior of the emplaced waste packages would be continuously evaluated so that potential contamination would be detected and prevented. After closure, it is expected that some monitoring will continue at the site.

The potential for contaminating the potable aquifers will be assessed during site characterization. Wells will be drilled to define the hydrologic properties at the site [illegible] confirm our ability to model and predict the movement of water at the site.

ANSWER 23: (cont'd)

The risk of contamination places high priority on our testing, construction, and sealing methods during site characterization and repository construction and operation to assure stability and performance of the lining seals. Contamination of the Ogallala and Dockum aquifers will be prevented through the use of ground freezing technology. This proven technology is over 100 years old and is widely used throughout the world for excavating tunnels and mine shafts where water is anticipated.

During shaft construction, seals and plugs will be placed at required intervals to prevent water from moving down the shaft as well as to protect water quality. The shafts will have a watertight lining made of an outer steel shell with an inner concrete lining, placed inside the preliminary concrete block shaft wall which extends from the bottom of the shafts.

For further detail see the following public information brochure Questions & Answers About the Potential Effects of a Repository on the Ogallala Aquifer, U.S. DOE, 1986.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 24:	Is the technology for freezing the ground during shaft construction considered adequate to protect the aquifer? How will you demonstrate this to NRC?
ANSWER:	Yes, the shaft freezing technology is considered adequate. In Texas, the shafts will pass through the Ogallala and Dockum aquifers. This will be done using a ground freezing technique which is widely employed for excavating tunnels and mine shafts where ground water is anticipated. To stabilize surrounding rock and control ground water during shaft construction, a freezing coolant is circulated through pipes to form a cylindrical ice column around the shaft. The ground is frozen below the lowest aquifer, at a depth of 1100 to 1200 feet, and the shaft is constructed, lined, and sealed.

The actual mapping and testing of the shafts as they are being constructed, and monitoring throughout site characterization, will provide the demonstration that the freezing technique results in a shaft capable of maintaining waste isolation.

Background: Some concerns that shaft construction may affect waste isolation stem from the possibility of disruption of the rock around the shaft, and also to possible interconnection of aquifers. Disruption of the surrounding rock may be caused by propagation of shocks from shaft blasts into

ANSWER 24: (cont'd)

surrounding rock. This is routinely controlled by the simple practice of fracturing the perimeter wall of the material to be blasted prior to the main blast. The fracture effectively hampers the transmission of the blast shock.

Hydrologic connections will be avoided by the use of seals between hydrologic units. These units will be precisely defined by the engineering design borehole cores and downhole logging before shaft construction begins. Horizontal seals around the shaft will prevent interactions between different water bearing units.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 25: There was an accident in the salt site in Gorlebin, West Germany where a worker was killed when the shaft lining buckled under creep.

-- What is the relevance of this incident to the Deaf Smith site?

-- How would you prevent a similar incident?

ANSWER: At this time, only preliminary information is available concerning the accident at Gorleben. The Germans are conducting a full investigation of the shaft accident. When the report is issued, we will examine it carefully to determine any relevance to the Deaf Smith site.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 26: A major issue raised by Texas State officials about the Deaf Smith site is that it is located in the midst of very productive farm land. You have described how many acres of land will be affected and how DOE will go about acquiring the land.

-- But this land is privately-owned and the landowners have been strongly opposed so far. Won't land acquisition be very difficult? Isn't it likely that DOE would have to condemn the land?

-- Is it realistic to assume that land acquisition will be completed on a reasonable schedule, or is site characterization likely to be delayed significantly because of this issue?

ANSWER: With the exception of a small piece of land which DOE expects to purchase, most activities associated with site characterization will require access by lease or right of entry. DOE feels these activities can be conducted in a manner that minimally impacts farm operations in the area. Because of this and because of the fair compensation offered for access, DOE expects that a large percentage of negotiations for access will not require condemnation proceedings. However, should condemnation be required there is adequate time in the project schedule so that the site characterization schedule should not be significantly impacted.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 27: The Deaf Smith site is the only one of the three candidate sites that is not located on federally owned land.

-- What type of permitting will be required?

-- Isn't there a state law that will make it very difficult to obtain permission to drill an exploratory shaft at the site?

ANSWER: The process for obtaining permits, approvals, and authorizations required for site characterization activities is shown on Tables 6-2 and 6-3 of the Deaf Smith Environmental Assessment. Further study of specific environmental regulatory requirements of each permit, approval, and/or authorization is being elaborated in an Environmental Regulatory Compliance Plan (available on Sept. 1, 1987).

Applicable environmental requirements that Federal agencies must comply with ultimately find their source in a Federal statute, regulation, or Federal Executive Order. Various Federal environmental statutes (e.g., the Clean Air Act, the Federal Water Pollution Control Act, as amended by the Clean Water Act, and the Safe Drinking Water Act, as amended) contain sections which mandate that Federal agencies comply with all State and local requirements relative to the scope of the Federal act, just as any private party must comply with those requirements.

ANSWER 27: (cont'd)

These key Federal regulatory programs are structured so that following delegation of authority, the States can administer and enforce the Federal regulatory program in the State. In such cases, some discretionary authority may be exercised by the State; thus, consultations with various permitting agencies are required before DOE will know if a permit may be contested. Such discussions with the State of Texas permitting agencies are anticipated on the first of September, 1987. DOE plans to comply with the State and local requirements to the extent that they are not inconsistent with DOE's responsibilities under the Nuclear Waste Policy Act of 1982 and other Federal laws.

In summary, the DOE notes under federally derived, State administered environmental regulatory programs "affected persons" (individual private citizens, private organizations, and other governmental agencies) in pursuit of their interests have the right to contest both DOE actions to gain regulatory approval as well as the relevant regulatory agencies' responsive actions. Thus, DOE recognizes that its pursuit of various environmental regulatory compliances may be contested and with reasonable assurance, will be contested.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 28: DOE's inability to pay impact aid during site characterization has been a major issue of contention with the State of Texas. However, DOE plans to move a large number of people into the area.

-- Will this be a major problem for the community?

-- How will DOE address the issue?

-- Could the problem be minimized by a more gradual influx of DOE and contractor personnel into the area?

ANSWER: DOE has met with local providers of public services in Amarillo, Canyon, Hereford, and Vega, Texas to determine service capacities and how they would be impacted by the move of DOE and contractor personnel to the area. These communities seem to be able to absorb the in-migrating personnel without significant adverse impacts. Specific services in specific areas will be monitored very closely, however, because of uncertainties as to where in-migrating workers may choose to live and services which are at capacity. These are: the water supply, schools, and sewage treatment facility in Vega, all of which have been reported to be at capacity; the schools in Hereford, specifically the elementary schools, which have been reported to be at or near capacity, and the possible need for additional teaching staff in the Canyon schools.

QUESTION 28: (cont'd)

DOE is monitoring the residential choices of in-migrating workers as they start their employment in the Hereford offices. These reports are provided weekly in summary form to local officials in Deaf Smith County as well as to school superintendents in other communities. DOE will continue to monitor actual relocations and estimate potential impacts as new information becomes available.

DOE has also surveyed personnel who have not yet moved to the Panhandle, asking them their preferences of residential communities. Based on the results of this study, it appears that a clear majority of the in-migrating staff will choose Amarillo as their place of residence, a community with ample service capacity. Other preferences were Canyon and Hereford and both communities seem able to absorb the influx of these workers.

Additionally, DOE has provided funds to the State of Texas for an independent assessment of the impacts of the relocation. The State is working with local planners and officials in the Panhandle to develop this study. The State report is expected to be completed in August 1987.

QUESTION 28: (cont'd)

The relocation of staff to the Panhandle has proceeded at a more gradual rate than originally planned. As the schedule for the construction of the Exploratory Shaft Facility has been delayed, the influx of workers will be spread over a longer time, with the peak of in-migration not occurring until late in 1989. This schedule should allow more than two years for DOE and local officials to prepare for changes and for DOE to develop mitigative measures, if they are necessary.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 29: Bedded salt is not clean--there are layers of other rock present within it. How will this affect safety?

ANSWER: We recognize that the salt bed under consideration has clay and other materials in it. Our tests so far show that the salt is sufficiently pure and thick--more than 100 feet--to safely host a repository, which requires a thickness of about 25 feet. Evaluation of the geologic data at repository depth during characterization will confirm regional data and provide definitive site-specific data for repository design and license application if the site is chosen as a repository site. Extensive geomechanical testing will be performed both in the lab and underground to further evaluate the safety aspects with respect to construction and long term isolation. Heterogeneities in the rock can potentially affect safety, and we will carefully study these heterogeneities during site characterization.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 30: Are there vertical faults present in the bedded salt? How do you characterize them and how do they affect safety?

ANSWER: There are known faults in the basement rock at 8,000 to 9,000 feet below ground surface in the vicinity of the site. But the faulting dies out (cannot be seen on seismic surveys) below the salt layers. The salt layer that will be characterized is 2,500 feet below the ground surface, and based upon regional data, it shows no evidence of vertical faulting. Site characterization studies will include seismic data collection, as well as collection of rock core through the geologic section, to further determine the extent of faulting in the site area. Based on current data, faults would not have a great impact upon repository safety. Waste canisters would not be stored near faults (if any were discovered) so as to avoid possible rupture from fault movement.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 31:	What are the potentially "fatal" flaws at Deaf Smith? Is your test program structured to answer these questions first, or at least, early on? If not, please explain why not. Would this be possible?
ANSWER:	As discussed in the Environmental Assessment (EA), fatal flaws are not expected at the Deaf Smith site because the process of site screening explicitly avoided features that could become fatal flaws. The EA did identify potentially adverse conditions at the site that will have to be addressed as part of site characterization. The major ones are:

1) ground-water hydrologic system - we must be able to prove that if ground-water comes in contact with the waste, the releases to the accessible environment in 10,000 years can not exceed those limits specified in 40 CFR Part 191. The test program is structured to evaluate this concern during the borehole drilling program that will be initiated early in the site characterization program.

2) thermo-mechanical characteristics of the rock - to allow us to emplace the necessary volume of the waste within the given space at an acceptable heat loading. Thermo-mechanical characteristics can be best evaluated in the exploratory shaft facility; therefore, final

QUESTION 31: (cont'd)

resolution of this concern will not occur until late in the site characterization program.

3) brine volume and chemistry - we must be able to demonstrate a waste package design that withstands the amount and corrosivity of the brine at the site. Brine volume and chemistry can best be observed in situ during and after exploratory shaft construction. Early drilling activities address this concern; however, a thorough assessment of the waste package environment will depend upon results from the underground test facility.

4) shaft sealing - see discussions in Questions 23 and 24. The exploratory shaft is the first test of our ability to effectively seal off the salt horizon from overlying aquifers. Information from the sealing and materials testing programs will be used in the final repository shaft design. Seal performance will be monitored throughout operations.

5) host rock thickness - we must have enough salt with minimal interbeds to accommodate the

QUESTION 31: (cont'd)

facility. Predictions of host rock thickness will be confirmed during borehole drilling before shaft construction.

Our test programs during site characterization are designed to resolve these and many other issues in the engineering, geohydrologic environmental, and socioeconomic areas. The Site Characterization Plan and site study plans will describe how this will be done. The purpose of site characterization is to determine whether the site is suitable for a repository. Performance assessments will be used to identify potential events, features, and processes that could disturb the repository's performance.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 32: What has been learned already about basalt through testing at the Near Surface Testing Facility at Hanford?

ANSWER: The Near Surface Test Facility (NSTF) has provided considerable information about the construction of drifts and shafts, and "breaking-out" from a shaft in confined conditions. Thus, it has provided valuable, practical experience in the use of equipment and development of construction and testing techniques. A variety of tests have been conducted over the years to determine rock properties, strengths, hardness, and the behavior of large jointed masses under conditions of stress and temperature. However, since it is a near-surface facility and therefore lacks prototypic temperature and in-situ stress conditions, which can only be found at depth, added supplemental and confirmatory data will have to be secured at depth.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 33: What are the most difficult technical problems to answer in order to get a license for a repository in Hanford basalt? Is your testing program structured to deal with these issues early in the process?

ANSWER: The most important technical problems and questions that need to be addressed prior to submitting a License Application are those set forth in the regulations at 10 CFR 60, 10 CFR 960, 40 CFR 191, and are further amplified in the Mission Plan Key Issues regarding site characterization. The most important site-related concerns in the above regulations involve long-term postclosure issues, including: a) successful waste isolation and confinement, and b) practical constructibility within a reasonable cost.

The BWIP testing strategy and program is currently tailored to address those items identified in the regulations which bear most heavily on the above. Regarding waste isolation, the program strategy and design is geared to secure the information needed in the areas of groundwater travel time, and those which bear on radionuclide release limits in an early, up-front manner. A comprehensive geotechnical and waste package testing and field program has been designed. The elements of it which need to be pursued early, such as the Hydrology Field Program, are already being discussed with NRC

ANSWER 33: (cont'd)

and other concerned parties. Other programs dealing with worker safety, the public, feasibility of construction, stability, and cost as well as other considerations that have surfaced in a comprehensive analysis of the Mission Plan/Key Issues have all been prioritized, integrated and identified for inclusion in the overall program and will be appropriately described in the Site Characterization Plan.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 34: Is it possible to make calculations of groundwater travel time with a high degrees of certainty?

ANSWER: The groundwater travel time requirement of "at least 1,000 years" (10 CFR 60.113(a)(2)) focuses attention upon determining the likelihood that groundwater travel time will exceed 1,000 years. The degree of certainty in calculating a travel time greater than 1,000 years depends on how much the "true" travel time exceeds 1,000 years. If the true travel time were 100,000 years, high certainty of exceeding 1,000 years would be obtainable with a relatively moderate characterization effort. Conversely, if the true travel time were 2,000 years, a high certainty in exceeding 1,000 years would require more characterization.

A high degree of certainty in calculating whether groundwater travel time exceeds 1,000 years is possible and it is primarily a question of obtaining enough data of the proper type. The BWIP Site Characterization Plan and sub-tier plans describe the data and analyses necessary to achieve

ANSWER 34 (cont'd)

this goal. Characterization will provide definition of the parameters of the groundwater travel time equation at a variety of scales. Large scale tests will yield average properties as well as information on the possible existence of especially rapid pathways. Small scale tests provide information on the variability of the groundwater properties. Additionally, hydrochemical and geochemical data will provide supplemental information on travel time estimates. These data have the potential of providing an independent estimate of groundwater travel time. Agreement would enhance the certainty in the computed travel times.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 35: How will you answer questions on the vertical movement of water?

ANSWER: A key element of the site characterization effort is the large-scale hydraulic parameters, including vertical conductivity, that, together with pre-testing potentiometric baseline data will allow DOE to assess the potential for vertical movement of groundwater. A preliminary estimate of the rate of vertical groundwater movement may be possible before the initiation of exploratory shaft drilling. However, the issue may not be fully assessed until the site is characterized. Hydraulic and hydrochemical data will be used in the evaluation.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 36: How and where does water at the repository depth communicate with the Columbia River?

ANSWER: This question cannot be answered at this time. Site characterization is required to resolve the question. The Regional Hydrology Study Plan, that will be published with the Site Characterization Plan describes the tests that will close this question. The Columbia River is the ultimate discharge point for water at the repository depth. However, estimates based on existing data, presented in the BWIP Environmental Assessment, indicates travel time to the accessible environment is within regulatory limits.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 37:	Basalt is very hard and will be quite hot at repository depth. Does the difficulty of mining and construction in basalt make the site less attractive?
ANSWER:	The temperature conditions at depth at the repository location are not a function of rock type. The temperatures are not extremely high and mining is currently undertaken in similar conditions around the world. Ventilation and cooling systems designed for the expected underground conditions should provide a workable environment.
	Construction in the hard rock would make the repository more costly; however, the fact that basalt is a hard rock does not, of itself, make for difficult mining. Excavating through hard rock with properly designed equipment in BWIP's view should present no problems that are not handled regularly in the mining industry. Although basalt is a jointed rock, it is not a unique condition in the mining industry and appropriate measures will be taken to provide necessary rock support. Construction and testing of and in the Near Surface Test Facility has provided BWIP with experience and data which will aid in design and construction of the Exploratory Shaft Facility and, if selected,

ANSWER 37: (cont'd)

the repository. The Department feels confident that in-situ rock stresses can be addressed within available technology.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 38: What is the distance from the Cohasset Flow to more porous layers? Please comment on how water in the basalt flow will communicate with the adjacent layers of rock.

ANSWER: Presumably, your interest lies in a description of the vertical distance to more transmissive zones, those that may yield significant quantities of groundwater to wells or provide significant paths for groundwater movement. Increased porosity alone may not affect yields to wells or groundwater travel.

The potential repository location is the dense interior of the Cohassett flow which is at a depth of 3100 feet. The flow tops of the Grande Ronde formation have transmissivities typically four orders of magnitude higher than the dense interiors. However, these values are not in the range of what is considered to be good aquifers. For instance, at the exploratory shaft location the Cohassett flow top is not expected to be transmissive enough to perform pumping tests and the Rocky Coulee flow top is expected to support a sustained pumping test discharge rate of less than ten gallons per minute. The nearest zone(s) that may be considered as good aquifers are located in the Wanapum formation. The Priest Rapids and Roza members are considered to be good aquifers. They are approximately 1300 feet above the repository.

ANSWER 38: (cont'd)

Existing piezometric data in the controlled area study zone indicates an upward potential for groundwater movement through the repository horizon. This gradient is very small (1 foot rise in 10,000 feet). Groundwater movement is further hindered by very low transmissivities. Discussions of the range of possible conceptual flow models are found in Section 3.3.2.2 of the BWIP Enviornmental Assessment.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 39: At Hanford, cost is much higher, why?

-- Please provide the most recent estimates for the cost of site characterization, and for the cost of construction of a repository.

ANSWER: The major factors contributing to the higher costs of Hanford relative to the other four sites nominated for characterization are as follows:

1) total number of shafts required for underground access;
2) need for hydrostatic lining for these shafts;
3) excavation method and associated labor productivity;
4) great depth and high in-situ temperature;
5) backfilling duration;
6) staffing levels;
7) number of waste packages; and
8) transportation cost.

The costs of site characterization in constant 1986 dollars for the Hanford site are estimated to be 1.6 billion dollars. This cost estimate includes all costs occurring from Presidential approval of the site through submittal of the license application. Included are costs for site-data collection and analysis, waste package design and development, repository design, grants to States and Indian Tribes, payments-equal-to-taxes to States, Indian Tribes, and units of general local government, and licensing interactions.

In regard to repository costs, construction costs account for about 20 percent of the total costs. The four major factors that control construction

ANSWER 39: (cont'd)

cost differences among sites are:

1) waste-handling facilities;
2) site access;
3) underground facilities; and
4) ventilation requirements.

Construction of these surface and underground facilities at the Hanford site is estimated to cost about 3.0 billion dollars (constant 1986 dollars). It should be noted that these cost estimates are considered more indicative than substantive because present repository designs are very preliminary, and unanticipated changes could markedly change both the relative and absolute cost estimates for repositories at the three candidate sites.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 40: Grant funding given to States for independent review has been a continual bone of contention between DOE and the States.

a: When do the States send requests to DOE?

b: Are requests frequently received after the Department's overall budget to Congress has been formulated?

c: Can these grant requests be easily factored into the Department's overall budget request?

d: In order to honor the States' grant requests, do the field offices ever have to dip into their own budget?

ANSWER 40a: Grant applications are scheduled to be submitted to the Department approximately four months prior to the expiration of the current grant. Some of the grants, for example, Yakima and Umatilla, operate on a fiscal year basis; others, for example, Nevada, Texas, and Washington, operate on a calendar year basis.

ANSWER 40b: Yes. As stated in answer to Question 40a, grant applications are submitted to the Department approximately four months prior to the expiration of the current grant. Grants are funded on a 12-month basis and each year the States and Indian Tribes must submit new grant applications when their current grants near expiration. Because of the timing of the individual grant awards, some grant applications are submitted to the Department after the Department's overall budget for the current fiscal year has been formulated.

ANSWER 40: (cont'd)

ANSWER 40c: The Department has been working with the States and Indian Tribes in an effort to develop realistic three-year grant projections. In this way, the Department can factor the States' and Indian Tribes' grant needs into the overall budget process.

ANSWER 40d: Sufficient funds are available within each field office for the grants.

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 41: There is currently an on-site representative from the Nez Perce Indian Tribe at the Hanford reservation.

a: Are there plans for having on-site representatives from the other Indian Tribes or the State?

b: Do on-site representatives have full access to DOE officials and contractor personnel?

c: Are there State representatives on-site at Yucca Mountain? Or are there plans for this in the future?

ANSWER 41a: Yes. Currently the Confederated Tribes of the Umatilla Indian Reservation and the Nez Perce Tribe share the on-site representative. The Yakima Indian Nation and the State of Washington have had for the past two years grant funds to hire an on-site representative. To date, they have not hired a representative.

ANSWER 41b: The on-site representatives have full access to DOE officials and contractor site personnel. The representative is given the same access as the NRC representatives.

ANSWER 41c: The State of Nevada does not yet have field personnel permanently on-site, however, State technical representatives participate in monthly technical project office meetings and other on-site meetings as appropriate. NNWSI has offered the State office space in the administration and engineering

ANSWER 41c: (cont'd)

building at the Nevada Research and Development Area of the NTS. The State has indicated that it will take advantage of the offer.

The Department attaches great importance to the participation of technical representatives of the States and Indian Tribes in the repository program. In fact, in a letter to the State of Texas concerning its 1987 grant, the Department urged the State to assign an on-site technical representative to the program when site characterization activities commence in the Panhandle.

Enclosure A

BASALT WASTE ISOLATION PROJECT

- LETTER REPORT ON ONGOING AND PLANNED ACTIVITIES -

DOCUMENTATION OF ONGOING ACTIVITIES

INTRODUCTION

BACKGROUND

During a meeting between the Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC) on May 7-8, 1986, DOE agreed to provide potential host states and affected Indian tribes (affected parties) documentation of ongoing activities and activities to be conducted before the Site Characterization Plans (SCP) are issued. This report provides that documentation.

While the Nuclear Waste Policy Act (NWPA) of 1982 calls for DOE to prepare and issue an SCP to the NRC and to affected parties before the sinking of exploratory shafts at any candidate sites, some research is underway at the candidate repository site on the Hanford Site already. This report summarizes ongoing and planned site characterization activities at the Basalt Waste Isolation Project (BWIP) in Washington State. This report's purpose is not to replicate the SCP but to list the activities BWIP is undertaking between the Presidential approval of sites for detailed characterization and the scheduled release of the SCP.

It is expected that all ongoing and planned activities will be presented in SCP Chapter 8, even though such activities began before the SCP is released. The DOE Project Offices will meet with affected parties to discuss the activities and identify workshops to cover tests in more detail.

DEFINITIONS

Site characterization is defined in NWPA Section 2 (21)(B) as "activities, whether in the laboratory or in the field, undertaken to establish the geologic condition and the ranges of the parameters of a candidate site...., needed to evaluate the suitability of a candidate site for the location of a repository."

Ongoing activities are as those that were in progress when the President approved the Hanford Site for characterization (May 1986).

Shortly before the Presidential approval of the Hanford Site for site characterization, DOE imposed a stop work order on activities at the Hanford Site. The stop work order's purpose is to put into place quality and management systems to ensure the project's work will meet the rigorous quality standards the licensing process will require. Exempted from the stop work order were certain activities, such as ongoing data gathering activities for which interruption could result in loss of significant data; safety, quality assurance, or strictly administrative activities; and SCP preparation.

Planned activities are defined as the site characterization activities that have been started, or are planned to be started, after the Presidential approval (May 1986) but before the expected date of the SCP issuance.

Some activities at BWIP are affected by the stop work order. Since the restart date is problematic and the release of the SCP may be rescheduled, readers should bear in mind that some listed activities may in fact not start or resume before the release of the SCP.

SCOPE

A number of activities may have been completed before the Presidential site approval but not reported in the environmental assessments. While this report does not address those activities, the SCP will describe their results.

ORGANIZATION

The report is organized to describe concisely ongoing and planned site characterization activities and their rationale or purpose. The activities are organized as follows:

Hydrology program activities characterize the site and support the development of a conceptual model(s) to support performance assessment. Models are used to determine the direction and rate of groundwater movement.

Geology program activities characterize the site and support development of stratigraphic and tectonic models, which in turn support performance assessment and design work.

Geomechanics program activities measure those engineering parameters that describe mechanical, thermal and thermomechanical behavior of the repository host rock, and evaluate "opening" performance and stability. Studies are also designed to determine properties of rock support system components.

Geochemistry program activities cover three main areas: Site geochemistry, rock geochemistry and engineered barriers geochemistry. Site geochemistry concentrates on characterization of groundwater chemistry and radionuclide transport behavior in groundwater flow systems between the repository and the accessible environment. Rock geochemistry evaluates the chemical stability of mineralogic phases and assesses the total geochemical environment as reflected in mineral assemblages over the same scales. Engineered barriers geochemistry supports the development of geochemical model(s) of the post-emplacement environment of the waste package and the disturbed zone, followed by performance assessment.

Repository Seals program activities comprise investigations that assist in design and development of postclosure repository seals, which will contribute to the meeting of the NRC and U. S. Environmental Protection Agency standards for waste isolation.

Waste Package Component Interactions are tested to provide a licensable, environment-specific, materials performance database required to select materials and design a waste package for a repository constructed in basalt, and to predict its long-term performance confidently.

ONGOING SITE CHARACTERIZATION ACTIVITIES

HYDROLOGY TESTING

Hydrological Monitoring:

Approximately 45 boreholes isolating various confined and unconfined units are being monitored weekly to measure the depth to water at the measured horizons. The potentiometric data are used to support conceptual modeling of the groundwater system beneath the Hanford Site by enabling the determination of the direction of groundwater flow. Monitoring sites are identified in Figure 1. This activity supports the studies identified in SCP Section 8.3.1.3.

Monitoring at the DC-19, DC-20, DC-22, RRL-2, and DC-23 Sites:

Monitoring continues daily. The measuring of depth to water is being conducted to determine the flow direction of the basal Ringold Formation and selected Saddle Mountain, Wanapum, and Grande Ronde flow tops. Monitoring sites are identified in Figure 1. This activity supports the studies identified in SCP Section 8.3.1.3.

GEOLOGY TESTING

Seismic Surveillance Data Collection and Analysis:

Three seismic surveillance arrays consisting of the University of Washington, Eastern Washington and Northern Oregon array, the Hanford Site surface array, and the borehole seismic array (Figures 2, 3 and 4) provide coverage of seismic activity of the site and region. This activity is continued to assure that no significant seismic events are missed. These data will aid in the prediction of ground motion at the site to support preclosure design and safety performance as well as the possible impact of future earthquakes on the long-term performance of the site. Seismic surveillance activities are discussed in SCP Section 8.3.1.2.4.3.3.1.

Corehole DC-18:

Corehole DC-18 was drilled into the Ginko I flow, where drilling was stopped until the completion of the SCP. Straddle packers will be installed to isolate water-bearing zones. This borehole was drilled to assess stratigraphy, hydrology and hydrochemistry near the axis of the Gable Butte/Gable Mountain anticline (see Figure 1). Geochemistry information will provide additional data on groundwater flow paths and velocities, help determine radionuclide mobility and provide hydrochemistry environmental baseline data for future repository monitoring. Information from this borehole will provide data on the structure within an anticlinal ridge. This activity supports the studies identified in SCP Sections 8.3.1.2, 8.3.1.3, and 8.3.1.4.

GEOCHEMISTRY TESTING

Natural Analog Studies:

Literature, field, and laboratory studies are being conducted on the Icelandic basalt geothermal fields and the Grande Ronde Basalts in Oregon. Rock and/or water samples collected in the field are examined using standard laboratory techniques to determine mineralogy, trace element distribution, chemical composition, etc. These data are then used to establish the validity of the natural analog and to provide a basis for the long-term extrapolation of basalt and basalt alteration product behavior. For example, natural analog data will be used to evaluate the long-term minerological stability under hydrothermal conditions of clay alteration products similar to those proposed for the waste package packing. Data also may be used to validate long-term model predictions of basalt/packing behavior. This activity supports the studies identified in SCP Sections 8.3.4.2 and 8.3.4.2.3.3.

Support to Site Department Database:

This activity gives technical input to the operation (data for entry, modes of entry, identification of data) of the NOMAD database, which contains the geochemistry and hydrology data used in site characterization. This database is needed to develop an understanding of the site's hydrology and, ultimately, its waste isolation potential. This activity supports the studies identified in SCP Section 8.3.1.4.

Laboratory Analysis of Water from Boreholes, Springs, Unconfined Aquifers, and Other Test Horizons:

This activity's purpose is to provide baseline hydrochemical data to understand the groundwater chemistry before site characterization testing affects the natural system. This activity also is to determine whether the groundwater chemistry varies over time. Groundwater samples are analyzed by inductively-coupled plasma-atomic emission spectrometry (ICP-AES) and ion chromatography. These data are used as input to modeling of radionuclide release, since radionuclide solubility is a function of groundwater chemistry. This activity supports the studies identified in SCP Section 8.3.1.4.

Analysis of Dissolved Gases and Iron Species in Groundwater:

This activity supports the characterization of groundwater. The concentrations of gases and iron in solution can affect container corrosion rates and radionuclide solubility. Groundwater samples must be analyzed shortly after collection, in order to minimize degassing and changes in oxidation state. This activity supports the studies identified in SCP Section 8.3.1.4.

Analysis of Aqueous Solutions from Hydrothermal Testing:

This activity supports nonradioactive hydrothermal tests of packing material components, primarily basalt and bentonite. Solutions taken from autoclaves during tests are analyzed by ICP-AES and ion chromatography to determine concentrations of major and trace elements. The experiments are conducted to ascertain the geochemical stability of materials under repository-relevant conditions of temperature and pressure. This activity supports the studies identified in SCP Section 8.3.4.3.

Analysis of Selenium Species in Conjunction With Selenium Solubility Studies:

This activity provides analytical laboratory support to nonradioactive hydrothermal testing of basalt and bentonite in selenium-spiked groundwater. Selenium is a key element in nuclear waste, and knowledge of its geochemical interactions is important to the assessment of waste package performance. Solutions must be analyzed soon after sampling, to minimize the effects of possible changes in selenium oxidation state. This activity supports the studies identified in SCP Section 8.3.4.3.

Analysis of Solutions from Flow Top Sorption Experiments:

This activity supports experiments which study sorption phenomena in basaltic flow tops. The flow tops are the most likely zones of groundwater movement within individual basalt flows, and these experiments assess the retardation of radionuclide transport due to sorption onto primary and secondary minerals in flow top samples. This activity supports the studies identified in SCP Section 8.3.1.4.

Methods Development for Solution Analysis Using Atomic Absorption Spectrometry:

This activity's purpose is to develop analytical methods for determining concentrations of trace metals in groundwater and solutions from experiments. These methods are needed to assess baseline concentrations groundwater prior to the start of site characterization, and to support the interpretation of experiments critical to waste package design. This activity supports the studies identified in SCP Sections 8.3.1.4 and 8.3.4.3.

Waste-Barrier-Rock Interactions Testing:

Testing is performed under anticipated post-breach conditions (hydrothermal) using static and flow-through pressure vessels. This activity's purpose is to determine the radionuclide release behavior of the spent fuel and defense waste glass waste forms under expected repository conditions. These tests provide the radionuclide solubility/concentration data necessary to model and evaluate radionuclide releases from the waste package. The tests also provide information on the synergistic effects of waste package components on waste form radionuclide release behavior. This activity supports the studies identified in SCP Section 8.3.4.3.5.

Methods Development for Measurement of Dissolved Hydrogen:

The purpose of this activity is to develop methods to measure the concentration of dissolved hydrogen in solution samples from nonradioactive hydrothermal experiments utilizing basalt and bentonite. Hydrogen concentration influences the oxidation state of a solution, which in turn strongly affects radionuclide solubility. This activity supports the studies identified in SCP Section 8.3.4.3.

Analysis of Solid Reaction Products from Hydrothermal Experiments:

This activity provides identification and characterization of solid products from nonradioactive hydrothermal experiments. Scanning transmission electron microscope, electron microprobe, and X-ray diffraction analyses enable a determination of physicochemical changes in basalt and bentonite packing material components under repository-relevant temperature and pressure conditions. A complete understanding of packing material performance is necessary to determine its waste isolation potential and postclosure performance. This activity supports the studies identified in SCP Section 8.3.4.3.

Analysis of Minerals by Inductively-Coupled Plasma-Atomic Emission Spectroscopy:

This activity provides chemical analyses of minerals in support of site characterization studies and waste package design experiments. Minerals separated from natural samples or experimental reaction products are first identified by X-ray diffraction, and then chemically analyzed for major and trace elements by ICP-AES. The analytical data are necessary to correlate mineral composition with groundwater chemistry and to understand the geochemical behavior of key elements under repository-relevant conditions of temperature and pressure. This activity supports the studies identified in SCP Sections 8.3.1.4 and 8.3.4.3.

Basalt + Bentonite + Synthetic Groundwater Tests in Flow-through Autoclaves:

These experiments are being conducted to evaluate coupled transport and chemical reaction processes that might occur in the waste package and adjacent environment. The spatial and temporal evolution of alteration assemblages that can potentially affect the distribution of radionuclides released from waste forms is being studied. These experiments may place constraints on repository conditions that could maintain the system relatively far from equilibrium, thus producing metastable minerals that would persist for long periods and that would eventually interact with radionuclide-bearing groundwater. Finally, the data from these experiments act as baseline information to aid in the interpretation of later experiments with waste forms. This activity supports the studies identified in SCP Section 8.3.4.3.

Radionuclide-Doped Simulated Savannah River Plant Defense Glass + Basalt and Synthetic Groundwater:

Ongoing tests in this system have been completed. Test conditions were 85°C and 150°C at 10 MPa pressure in Dickson gold-cell autoclaves. Analyses are underway to determine radionuclide release rates from waste glass and radionuclide distribution between fluid and alteration phases. The data will be used as input to mass transport models to aid in the prediction of radionuclide migration. This phase of testing is now complete but further testing is anticipated. This activity supports the studies identified in SCP Section 8.3.4.3.

Analysis of Solid Reaction Products from Radionuclide Hydrothermal Tests:

This activity involves chemical and crystallographic characterization of reaction products from tests with defense glass utilizing scanning electron microscopy and X-ray diffraction. The results are required to determine the ability of minerals to incorporate radionuclides released from the waste glass under hydrothermal conditions. This activity supports the studies identified in SCP Section 8.3.4.3.

Hydrothermal Tests on Basalt + Bentonite + Groundwater:

Experiments have been conducted from 100°C to 300°C at 10 MPa pressure in Dickson gold-cell autoclaves and will continue several more months before completion. The objective of these tests is to define near-field chemical conditions and tb identify possible chemical interactions in the waste package. This activity supports the studies identified in SCP Section 8.3.4.3.

Long-Term Hydrothermal Tests With Basalt With or Without Bentonite + Groundwater:

A series of long-term (one to five-year) hydrothermal tests at 100°C to 200°C with vapor pressure curve autoclaves and cold seal autoclaves are being utilized to assess the stability of basalt and bentonite packing materials. These tests will also provide insight into the evolution of groundwater chemistry in the near-field environment of the waste package. This activity supports the studies identified in SCP Section 8.3.4.3.

Evaluation of Redox Conditions in the Near-Field Hydrothermal Environment:

Several experiments have been ongoing for the past year with basalt + groundwater mixtures in Dickson gold-cell autoclaves at 300°C and 30 MPa pressure. Dissolved hydrogen and sulfide/sulfate concentrations are being measured in these experiments to provide information for evaluating redox conditions in the near-field environment. Knowledge of the oxidation state of the fluid phase is important in assessing radionuclide solubility and canister corrosion rates. Further experiments are anticipated at temperatures of 100°C and 200°C with Dickson autoclaves and with flow-through autoclaves. This activity supports the studies identified in SCP Section 8.3.4.3.

Bentonite Dehydration Experiments:

Bentonite has been subjected to approximately one year of continuous dry heating in muffle furnaces at temperatures of 300°C and 460°C. Samples are periodically removed from the furnaces and characterized by X-ray diffraction, thermogravimetric analysis, and differential scanning calorimetry. The purpose of this study is to determine the effects of temperature on the dehydrated packing material that may result during the preclosure period of the repository. This activity supports the studies identified in SCP Section 8.3.4.3.

Selenium Solubility Experiments:

Several basalt + selenium-spiked groundwater experiments in Dickson gold-cell and vapor pressure curve autoclaves have been conducted at 150°C. The purpose of these experiments is to understand the chemical behavior of selenium with respect to solubility and oxidation-reduction chemistry in the near-field environment of a repository. Phase I of this testing is complete and further testing will resume when the stop work order is lifted. This activity supports the studies identified in SCP Section 8.3.4.3.

WASTE PACKAGE COMPONENTS INTERACTIONS

Radiolysis Effects Studies:

Studies on the irradiation effects on the environment consist of groundwater-basalt-waste package component interactions tests in the presence of gamma radiation. Testing includes solutions and solids analyses using standard techniques. Experimental techniques are being developed for alpha radiation testing. The purpose of these studies is to evaluate the effects of radiation on the waste package environment and waste package materials behavior. Data are used to determine the durability of materials exposed to radiation and the range of environmental conditions under which the waste package materials must perform. This activity supports the studies identified in SCP Sections 8.3.4.2, 8.3.4.2.2.3, 8.3.4.3.3.3, and 8.3.4.3.4.3.

Container Materials Testing Program:

Metallic container materials are being studied to evaluate their suitability as long-lived nuclear waste containers. Under investigation are general corrosion, pitting corrosion, and environmentally assisted cracking behavior of metals under anticipated repository conditions. Under study are iron and copper-based alloys. Data are used to select a container material for the waste package, to establish the necessary container thickness to ensure substantially complete containment will be maintained for at least 300 years, and to develop container materials degradation models used to evaluate container lifetimes. This activity supports the studies identified in SCP Section 8.3.4.3.3.

Packing Materials Radioactive Testing:

The packing materials' radionuclide sorption and diffusion are being studied in static and flow-through tests. Standard or well-documented methods for analysis of solids and solutions are being applied to test samples. The activity's purpose is to determine the composition and density required for the packing design and to evaluate transport of radionuclides through the packing, a waste package component, and subsequent release from the waste package. This activity supports the studies identified in SCP Section 8.3.4.3.

PLANNED ACTIVITIES

HYDROLOGY TESTING

DC-24CX and DC-25CX:

Rotary holes are planned south (DC-24CX) and east (DC-25CX) of the reference repository location. The holes will be completed as nested piezometers to monitor three Wanapum and four Grande Ronde flow tops. The data point will aid in determining the groundwater flow direction from the proposed repository location. Plans are to begin construction in early in 1987 and complete installations in approximately 90 days. This activity supports the studies identified in SCP Section 8.3.1.3.

DC-23GR:

After construction of DC-24CX and DC-25CX, piezometers will be installed in the Umtanum, Birkett, Cohassett, and Rocky Coulee flow tops at DC-23GR. The purpose of the piezometers is to add a monitoring data point north of the reference repository horizon. The data point will aid in determining the groundwater flow direction from the proposed repository location. This activity supports the studies identified in SCP Section 8.3.1.3.

GEOLOGY TESTING

Seismic Reflection/Refraction Data Collection:

Seismic reflection/refraction data will be collected in the immediate area of the Exploratory Shaft site (see Figure 4). This work is part of the overall seismic reflection/refraction testing and acquisition plan for characterization of the stratigraphy and structure of the site. The location of tectonic structures is important to the tectonic stability assessment and to the identification of groundwater flow-paths. Completion of this work is planned prior to the construction of the Exploratory Shaft to avoid interference from construction noise. Seismic reflection/refraction activities are discussed in SCP Sections 8.3.1.2.2.3.1.2 and 8.3.1.2.2.3.2.1.

GEOCHEMISTRY TESTING

Study of Kinetics of Decomposition of Hydrogen Peroxide With Basalt Using Ultraviolet-Visible Spectrophotometry:

This activity is designed to answer fundamental questions about the behavior of radionuclides in an environment containing hydrogen peroxide, which could be generated by the interaction of water with gamma rays from the waste package. Changes in the groundwater chemistry could affect radionuclide solubility and waste package performance. This activity supports the studies identified in SCP Sections 8.3.1.4 and 8.3.4.3.

Methods Development for Analysis of Halides in Basalt and Clays:

This activity will develop methods for determining the concentration of halides in basalt and clays. The study is required to assess sources of halides in basaltic groundwater. The concentrations of dissolved halides can affect the solubility, and hence the transport, of radionuclides. This activity supports the studies identified in SCP Section 8.3.1.4.

Analysis of Secondary Minerals in Basalt:

This activity will involve the characterization of secondary minerals in the dense interiors of basalt flows, using electron microprobe and X-ray diffraction analyses. These minerals are found in and adjacent to fractures and joints in the rock, as well as in vesicles and vugs. Such minerals decrease the porosity of flow interiors, and may sorb significant amounts of radionuclides released from the waste package. This activity supports the studies identified in SCP Section 8.3.1.4.

Analysis of Flow Top and Fault-Infilling Minerals:

This activity will involve X-ray diffraction identification of secondary minerals in basaltic flow tops and along faults. These minerals influence the chemistry of the groundwater in the proposed repository site, and are potential sorbers for radionuclides. This activity supports the studies identified in SCP Section 8.3.1.4.

Analysis of Corrosion Wafer Surface Coatings:

This activity will support experimental studies of container material corrosion. X-ray diffraction and scanning electron microscope analyses will be used to characterize the nature of the corrosion and identify its products. Corrosion studies directly support waste package design and performance assessment. This activity supports the studies identified in SCP Section 8.3.4.3.

GEOMECHANICS TESTING

Overcoring Development Testing With the Commonwealth Scientific and Industrial Research Organization (CSIRO) Triaxial Cell:

Overcoring is a widely accepted technique for measuring the magnitude and orientation of the in-situ stress field in a buried rock mass. Overcoring testing at the Near-Surface Test Facility (NSTF) has been directed toward evaluating test equipment and procedures and familiarizing BWIP personnel with overcoring methods. Results from NSTF testing will be used to finalize overcoring test procedures to be used in the Exploratory Shaft program. In situ stress data will be utilized in the repository design process to optimize the shapes and orientations of the various openings to be mined (shafts, drifts and placement holes) and to aid in predicting support requirements. Stress data also are inputs to numerical models that are under development for use in repository performance assessment applications. When the stop work order halted NSTF testing, eight CSIRO triaxial cells had been tested in a horizontal borehole and two cells had been overcored in a vertical borehole. A third cell, which was installed in the vertical borehole before the stop work order, may be removed for safety purposes before release of the SCP. The topic of in situ stress determination is addressed in SCP Section 8.3.2.2.2.3.1.

Rock Support Materials Testing:

These activities will determine the elastic, viscoelastic, strength properties, and durability of grouts, concretes, and shotcretes at ambient and elevated temperatures. Other candidate rock support system components to be tested will consist of rock aggregates and rockbolt products. The dimensional stability (shrinkage, swelling, slaking, etc.) of various cements and aggregates under ambient and elevated temperatures will be characterized. Data from these tests will be applied to: (1) prepare specifications for the rock support system to be installed in the Exploratory Shaft Facility and related Exploratory Shaft testing, and (2) provide input to the License Application repository design. This testing will take place in the laboratories in 200 East Area and at the NSTF in Gable Mountain, on the Hanford Site. Planned activities include test procedure and training plans preparation, equipment and materials sources evaluation, and test planning. Actual testing is not scheduled to resume before the release of the SCP. This activity supports the studies identified in SCP Sections 8.3.2.4.5, 8.3.2.4.6, 8.3.2.4.7, 8.3.2.4.8, and 8.3.2.4.9.

Thermal Conductivity/Thermal Expansion Development Testing:

This activity covers thermal property testing on reference standards and Pomona basalt rock specimens to check out the equipment, writing training plans, and providing data for procedure development. This information will support repository design and Exploratory Shaft construction and testing. Actual testing will not resume before the scheduled release of the SCP. This activity supports the studies identified in SCP Sections 8.3.2.2, 8.3.2.3, and 8.3.2.4.

Dowell's Chemical Seal Ring Tests:

This activity will determine physical, hydraulic, and mechanical properties of a candidate seal system for the Exploratory Shaft liner. Procedure and training plan development are planned activities, but actual testing will not resume before the scheduled release of the SCP. This activity supports the studies identified in SCP Section 8.3.2.4.

Thermal Property Tests on Reference Repository Location Core:

For this activity, core from the reference repository location boreholes will be tested to begin database development of thermal properties of Cohassett basalt. Procedure and training plan development are planned activities, but actual testing will not resume before the scheduled release of the SCP. This activity supports the studies identified in SCP Section 8.3.2.2.

Size-Effect Strength Testing on Cohassett Core:

This activity currently consists of uniaxial compressive strength tests and other physical property tests on core from reference repository location boreholes. Data will be used to support repository design and Exploratory Shaft construction. This activity supports the studies identified in SCP Section 8.3.2.2.2.

High-Temperature and -Pressure Triaxial Strength Test Developmental Testing:

This activity consists of developing the procedure and techniques to perform triaxial compressive strength tests at temperatures to 200°C and confining pressures to 138 MPa. Testing will be performed using core from the NSTF and reference repository location boreholes. The purpose of this testing is to characterize basalt rock strength for repository design and Exploratory Shaft construction. This activity supports the studies identified in SCP Section 8.3.2.2.2.

Fracture/Flow Study of Basalt:

The purpose of this activity is to develop a methodology for modeling the coupled mechanical-hydrological process of flow through joints and then attempt to validate a computer model using small-scale laboratory test data. Sample preparation and several mechanical properties tests on core are planned, and any further testing for this activity is still in the planning stages for later in fiscal year 1987. This activity supports the studies identified in SCP Section 8.3.2.3.

REPOSITORY SEALS TESTING

Hydraulic Conductivity Tests (Seals):

This activity's purpose is to evaluate the hydraulic conductivity of seals materials at various temperatures expected in the repository. Data will be used to support the design and performance of the repository seals. This activity supports the studies identified in SCP Section 8.3.3.3.

Mechanical Properties Tests (Seals):

The purpose of this activity is to evaluate the mechanical properties of consolidation, swelling pressure, and shear strength of seals' materials. Data will be used to support the design and performance of the repository seals. This activity supports the studies identified in SCP Section 8.3.3.3.

WASTE PACKAGE COMPONENT INTERACTIONS

Packing Development Investigation:

The current waste package design contains a packing material consisting of crushed basalt and bentonite clay, which fills the space between the metal waste container and the emplacement hole wall. This packing material provides a medium for limiting radionuclide releases from the waste package. This activity's objective is to determine the optimum basalt-bentonite mixture, fabrication and batching techniques to be employed, and the physical properties of the prototypic preformed packing rings. The physical model test assembly has been designed. When the stop work order is lifted, these investigations will include approval of the physical model test assembly, the resumption of materials selection and optimization tests, followed by physical properties and laboratory-scale tests. Packing development investigation is identified in SCP Section 8.3.4.4.4.

Prefabricated Packing Material Development:

This activity's purpose is to evaluate the mechanical properties of prefabricated packing materials for input to prototype design and numerical modeling. This activity supports the studies identified in SCP Section 8.3.4.3.

Hydraulic Conductivity Tests (Packing):

This activity's purpose is to evaluate the effect of hydraulic gradient on the hydraulic conductivity of packing material. Data will be used to support the waste package design. This activity supports the studies identified in SCP Section 8.3.4.3.

Triaxial Swelling Pressure and Shear Strength Tests:

This activity's purpose is to evaluate the swelling pressure and shear strength of packing material at ambient and elevated temperatures. Data will be used to support the waste package design. This activity supports the studies identified in SCP Section 8.3.4.3.

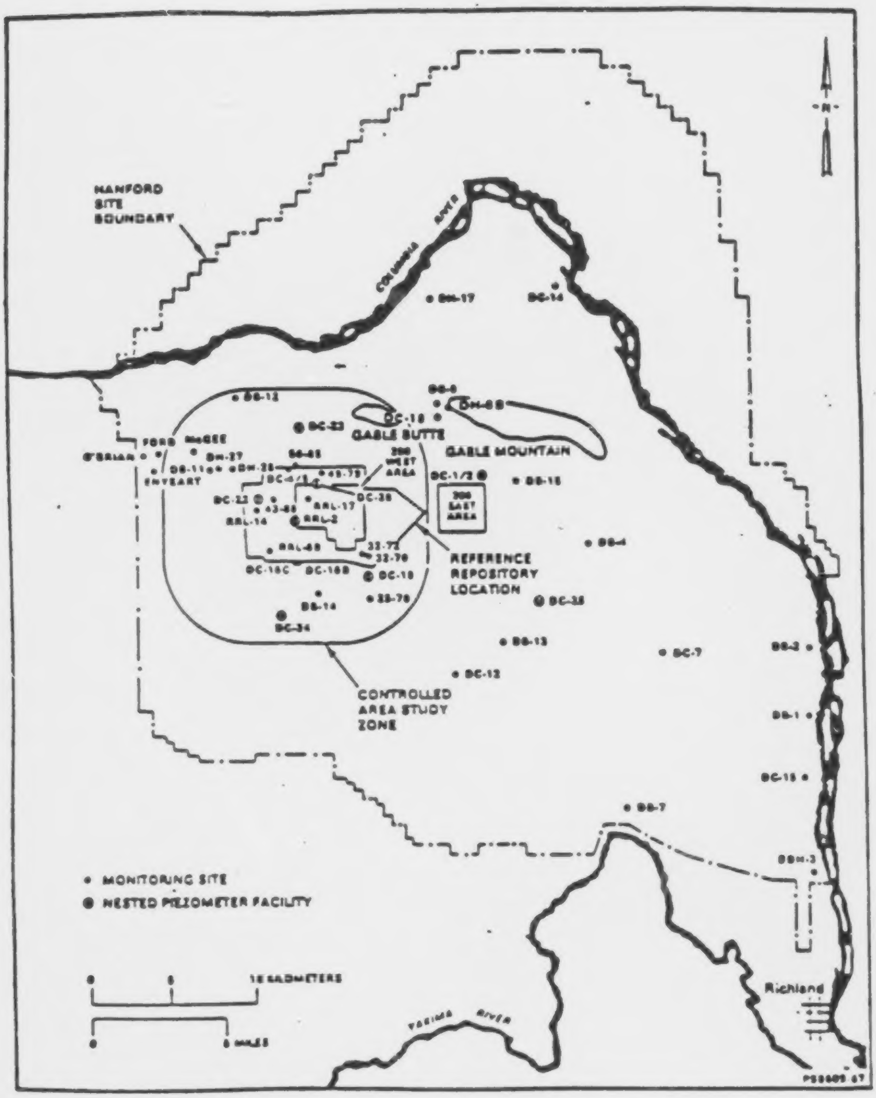
HANFORD SITE BOUNDARY
COLUMBIA RIVER
N
DH-17
DC-14
DB-12
DB-9
DH-8B
DC-18
DC-23
GABLE BUTTE
GABLE MOUNTAIN
FORD
McGEE
O'BRIAN
DH-27
DB-11
DH-28
ENYEART
200 WEST AREA
DC-1/2
DB-15
DC-22
43-68
RRL-17
DC-20
RRL-14
RRL-2
200 EAST AREA
DB-4
RRL-69
33-72
33-70
DC-16C
DC-16B
DC-19
REFERENCE REPOSITORY LOCATION
DC-25
35-70
DB-14
DC-24
DB-13
DC-7
DC-12
DB-2
CONTROLLED AREA STUDY ZONE
DB-1
DC-15
DB-7
MONITORING SITE
NESTED PIEZOMETER FACILITY
0
5
10 KILOMETERS
0
5 MILES
YAKIMA RIVER
Richland

FIGURE 1. Monitored Test Boreholes on the Hanford Site.

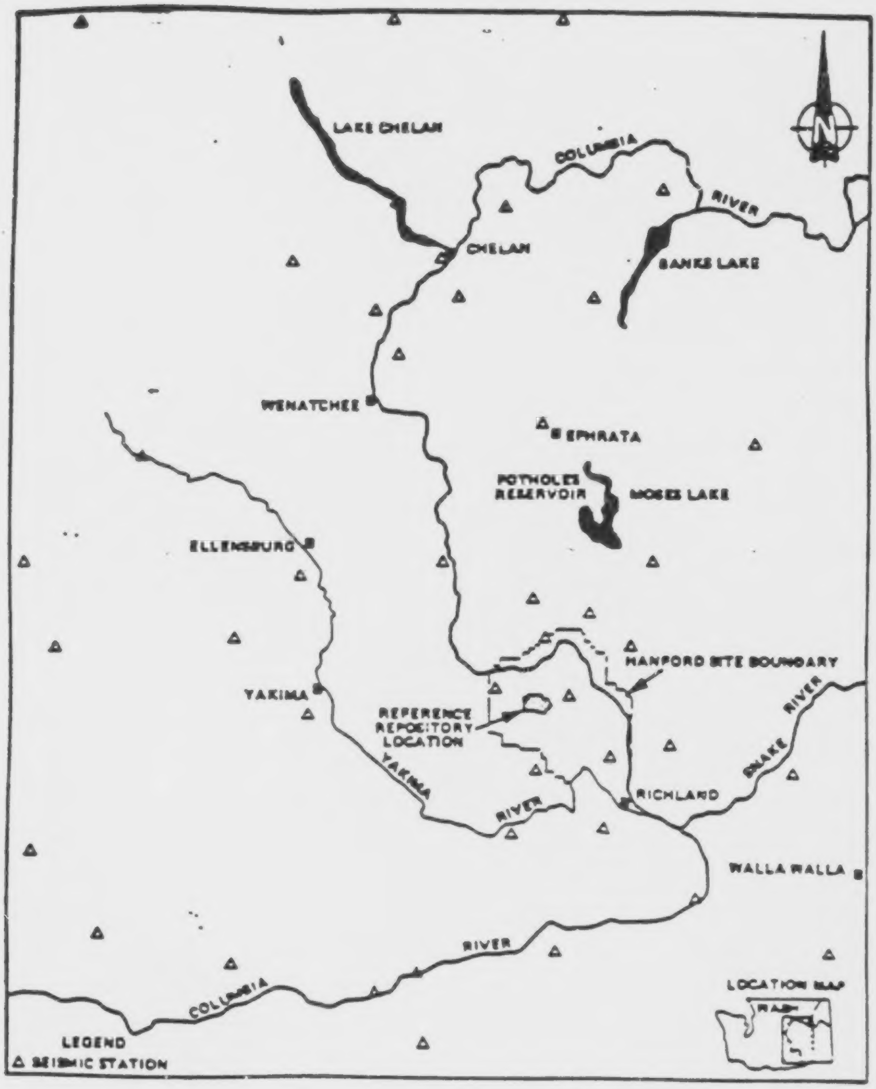
N
LAKE CHELAN
COLUMBIA
RIVER
CHELAN
BANKS LAKE
WENATCHEE
EPHRATA
POTHOLES RESERVOIR
MOSES LAKE
ELLENSBURG
HANFORD SITE BOUNDARY
YAKIMA
REFERENCE REPOSITORY LOCATION
SNAKE RIVER
YAKIMA RIVER
RICHLAND
WALLA WALLA
RIVER
COLUMBIA
LOCATION MAP
WASH
LEGEND
△ SEISMIC STATION

FIGURE 2. Location Map--University of Washington Regional Seismic Surveillance Network Stations.

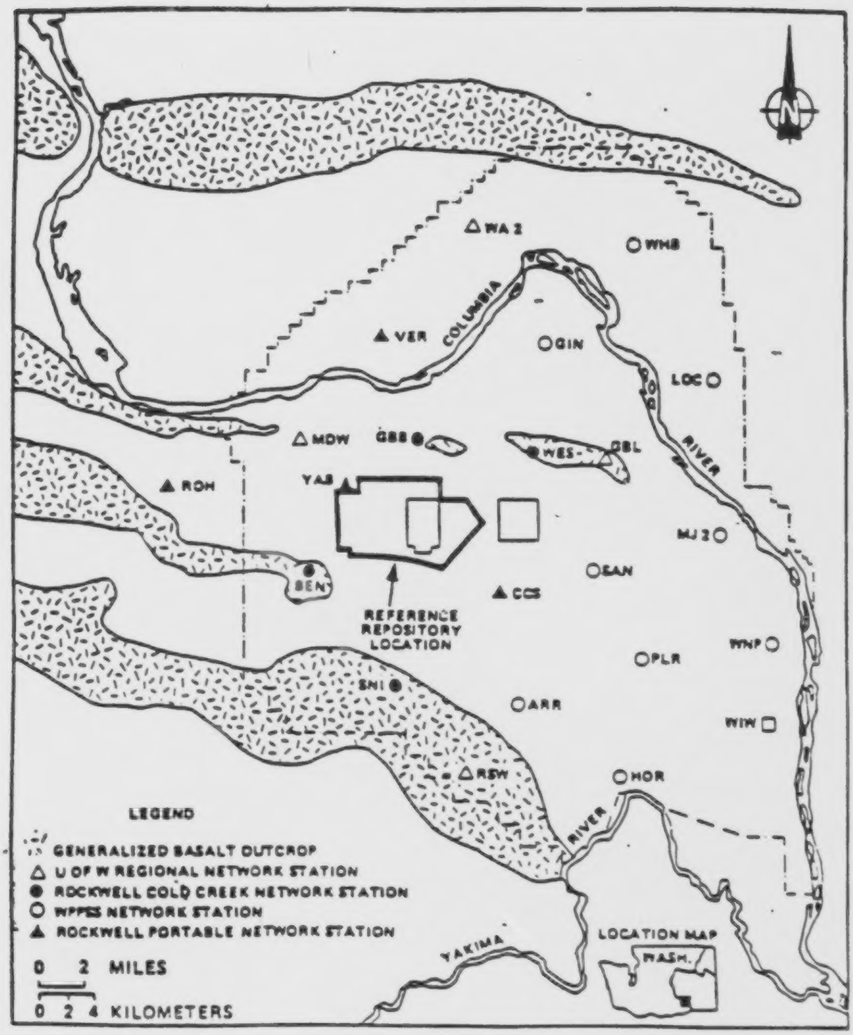
N
WA 2
WHB
VER
COLUMBIA
GIN
LOC
MDW
GBB
WES
GBL
RIVER
ROH
YAS
MJ 2
SAN
BEN
CCS
REFERENCE REPOSITORY LOCATION
WNP
PLR
SNI
ARR
WIW
RSW
HOR
RIVER
LEGEND
GENERALIZED BASALT OUTCROP
U OF W REGIONAL NETWORK STATION
ROCKWELL COLD CREEK NETWORK STATION
WPPSS NETWORK STATION
ROCKWELL PORTABLE NETWORK STATION
0 2 MILES
0 2 4 KILOMETERS
YAKIMA
LOCATION MAP
WASH.

FIGURE 3. Hanford Site Surface Seismic Network

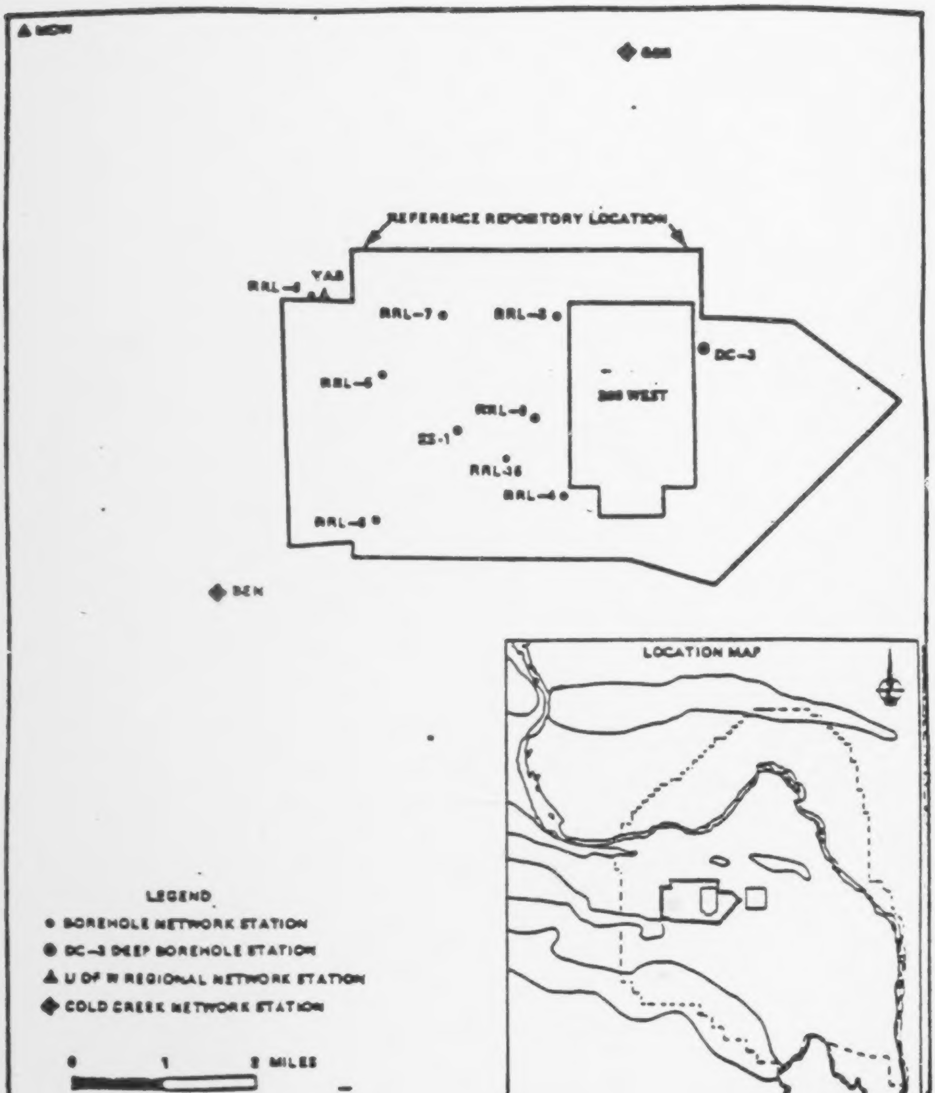
REFERENCE REPOSITORY LOCATION
YAB
RRL-7
RRL-2
DC-3
200 WEST
RRL-4
BEN
LOCATION MAP
LEGEND
BOREHOLE NETWORK STATION
DC-3 DEEP BOREHOLE STATION
U OF W REGIONAL NETWORK STATION
COLD CREEK NETWORK STATION
0 1 2 MILES
0 1 2 KILOMETERS

FIGURE 4. Location Map--Proposed RRL Borehole Seismic Surveillance Network and Existing Nearby Surface Seismic Stations.

Enclosure B

SITE, ENGINEERED BARRIERS, GEOMECHANICS, LABORATORY DEPARTMENT ACTIVITIES

Activities	Date	Rev.*
Site		
o Electronmicroprobe analysis of flow top samples	On Hold (Pending Stop Work Order)	
o X-ray diffraction analysis of flow top samples	On Hold (Pending Stop Work Order)	
o Modeling gravity, magnetic data	On Hold (Pending Stop Work Order)	
o Collection of maynetic and gravity data	On Hold (Pending Stop Work Order)	
o Seismic surveillance and data analysis	Ongoing	
o Lab studies on sorption and chemical dissolution	On Hold (Pending Direct Fund Contract)	22
o Conduct geologic field mapping	On Hold (Pending Stop Work Order)	
Site Characterization Field and Investigation		
o Drilling and testing of DC-18	01/28/86-11/86	
o Install Piezometers in DC-23GR	07/01-09/30/86	
o Initiate rotary drilling of DC-24CX	On Hold (Pending Stop Work Order)	
o Core drill DH-32	On Hold (Pending Stop Work Order)	
o Groundwater monitoring of boreholes DC-19, DC-20, DC-22, and RRL-2	Weekly	
o Monitoring of other boreholes	Weekly	
Solution and Solids Characterization Group		
o Support to Site Department database development	Ongoing	
o Development of methods for analysis using AA	- Work Package was stopped	
o Procedure development	Ongoing	
o Analysis of aqueous solution samples from hydrothermal testing and groundwater sampling	Ongoing	
o Field and laboratory analyses of water from local springs, unconfined aquifer, and other test horizons	Ongoing	
o Study of kinetics of decomposition of hydrogen peroxide with basalt under various conditions using uv-visible spectrophotometry	On Hold (due to Stop Work Order)	
o Development and initiation of improved methods of records retention	Ongoing	
o Support groundwater tracer analysis and groundwater sampling during large-scale hydraulic stress (LHS) testing	On Hold (due to Stop Work Order)	
o Analyses of selenium species in conjunction with selenium solubility studies with non-radioactive hydrothermal testing team	Ongoing (pending termination of hydrothermal experiments)	
o Analyses of minerals and clays by ICP-AES	Ongoing	
o Analyses of halides in basalt/methods development	Stopped (by Stop Work Order)	
o Provide analyses of dissolved gases, iron species, and dissolved oxygen on request for Hydrochemistry Group	Ongoing	

Activities	Date	Rev.*
Geochemical Testing Group		
Radioactive -		
o Basalt ± bentonite + synthetic groundwater tests in flow-through autoclave	Ongoing	
o Radionuclide-doped simulated Savannah River Plant Defense glass + basalt and synthetic groundwater	Ongoing (Testing continuing, no new tests to be initiated)	
o Experiments using fully radioactive waste forms in the presence of various waste package components (metal, barriers, and/or basalt)	PNL (BWIP work begins FY 1987)	
o Experiments on the behavior of specific radionuclides, introduced individually with groundwater, in the presence of packing material at low temperatures	Testing stopped, equipment and procedure work ongoing	
Nonradioactive -		
o Hydrothermal tests on basalt + bentonite + groundwater	Ongoing (no new testing to be initiated)	
o Long-term hydrothermal tests (1-5 years) on basalt + groundwater	Ongoing (no new testing to be initiated)	
o Determine the solubility of selenium under hydrothermal conditions simulating the near-field environment	Ongoing (Some developmental testing will continue to evaluate analytical methods and testing apparatus)	
o Evaluate Redox conditions in a hydrothermal experiment simulating a near-field environment	Ongoing (for duration of current tests)	
o Dehydration experiments	Ongoing (for duration of current tests)	
Packing Material and Repository Seals Testing Group		
o Fracture alteration testing	On Hold (not funded in FY 1987)	
o Hydraulic conductivity tests (packing and seals)	On Hold (Pending Stop Work Order)	
o Swelling pressure permeameter and triaxial tests (packing)	On Hold (Pending Stop Work Order)	
o Long-term flow through permeameter tests (packing)	On Hold (Pending Stop Work Order)	
o Swelling pressure permeameter and triaxial tests (seals)	On Hold (Pending Stop Work Order)	

Activities	Date	Page
Solution and Solids Characterization Group (Continued)		
o Methods development for measurement of dissolved hydrogen (H_2) in aqueous samples from autoclaves in the Non-radioactive Hydrothermal Laboratory	Ongoing	
o Analyze solutions from experiments on sorption phenomena of flow top materials being done at PNL	Ongoing	
Scanning Transmission Electron Microscope -		
o Analysis of flow-through run products	On Hold (due to Stop Work Order)	
o Analysis of Dickson autoclave run products	Old Work Ongoing. New Work is on Hold (due to Stop Work Order)	
X-Ray Diffractometer -		
o Analysis of flow-through run products	On Hold (due to Stop Work Order)	
o Analysis of Dickson autoclave run products	Old Work Ongoing. New Work On Hold (due to Stop Work Order)	
o Analysis of sedimentary interbed minerals	02/86-10/86 (Transferred-PNL)	
o Analysis of corrosion water surface coatings	Exempted (but Personnel not available due to Stop Work Order temporary assignments)	
o Analysis of flow top secondary mineralization	All Work On Hold (due to Stop Work Order)	
o Analysis of fault-infilling secondary mineralization	On Hold (due to Stop Work Order)	
Electron Microprobe -		
o Analysis of Dickson Autoclave run products	Old Work Ongoing. New Order Stopped (due to Stop Work Order)	
o Analysis of secondary mineralization in basalt	All Work Stopped (due to Stop Work Order)	

Activities	Date	Rev.*
Exploratory Shaft and Geomechanics Testing Group		
o Perform tests on shotcrete specimens	On Hold (Pending Stop Work Order)	
o Dowell's chemical seal ring tests	On Hold (Pending Stop Work Order)	
o Thermal conductivity/thermal expansion development testing	On Hold (Pending Stop Work Order)	
o Acquire calorimeter for heat capacity measurements and begin developmental testing	On Hold (Pending Stop Work Order)	
o Thermal property tests on RRL core	On Hold (Pending Stop Work Evaluation)	
o Size-effect strength testing of Cohassett core	On Hold (Pending Stop Work Evaluation)	
o High temperature and pressure triaxial development testing	On Hold (Pending Stop Work Evaluation)	
o Fracture/flow study of basalt	On Hold (Pending Stop Work Evaluation)	
Geomechanics Testing at Near-Surface Test Facility		
o Overcoring developmental testing with CSIRO triaxial cell	Terminated (Per Stop Work Order)	
o Rock support materials development testing	Suspended (Per Stop Work Order)	

*Changes in this schedule from that last issued are indicated by a revision bar and revision number. Items will remain on listing for a two-month period after completion.

Enclosure C

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

JAN 24 1986

Mr. Terry Husseman, Program Director
Office of High-Level
Waste Management
Washington State Department
of Ecology, MS PV-11
Olympia, WA 98504

Dear Mr. Husseman:

TECHNICAL COMMUNICATORS

Regarding our recent discussions on the above subject, we are herein providing your office with a listing of technical communicators and their respective technical discipline. The listing, with minor exception, is exactly the same as provided to the Nuclear Regulatory Commission (NRC), We wish to emphasize that the individuals listed are to be utilized as information facilitators and chartered to respond to simple requests/questions regarding documentation and project activities. The listing has no authority to present official DOE positions or to generate policy. In that regard all formal requests for information, responses to questions, establishment of meetings, workshops, and data reviews must be processed through our Licensing, Environmental and Safety Branch.

The following is a listing of the principle BWIP Technical Communicators and alternates for each area of discipline:

Topic	BWI Communicators Name	Telephone Number
Environmental/Socio-Economics Transportation	Steve Whitfield - DOE Jim Mecca - DOE	(509)376-2048 (509)376-5038
Geochemistry	Marv Furman - DOE Joe Krupar - DOE	(509)376-7062 (509)376-2385
Geology	Bruce Hurley - DOE Jim Mecca - DOE	(509)376-7059 (509)376-5038
Hydrology	Mike Thompson - DOE Jim Mecca - DOE	(509)376-6421 (509)376-5038
Performance Assessment	Tony Knepp - DOE John Kovacs - DOE	(509)376-4934 (509)376-1291
Repository Design	Bruce Nicoll - DOE John Kovacs - DOE	(509)376-6006 (509)376-1291

Waste Package	Phil LaMont - DOE	(509)376-6117
	Joe Krupar - DOE	(509)376-2385
Quality Assurance	Pierre Saget - DOE	(509)376-7250
	Joe Krupar - DOE	(509)376-2385

If you have any questions regarding this information, please contact Mr. Jim Mecca at (509)376-5038, or Mr. Max Powell of my staff at (509)376-5267. Upon your review of our above listing, we would appreciate your corresponding list by technical discipline and agency.

Very truly yours,

ORIGINAL SIGNED BY
O. L. OLSON

O. L. Olson, Director
Basalt Waste Isolation Division

BWI:JEM

Enclosure D

BASALT WASTE ISOLATION PROJECT

- Stop Work Order Report -

The following codes identify classes of exemptions from the stop work order issued in May 1986 for project work packages.

CODE/CLASS	EXEMPTION CLASS DEFINITION
D-GATHERI	Data gathering activities that are currently in operation and for which interruption could result in loss of significant data (e.g., seismic monitoring, piezometer well information, corrosion testing, etc.).
M-SUPPORT	All activities, including procurements, which support upgrading the BWIP management, operating, or quality assurance program. This includes all work that is necessary to achieve adequate implementation of the BWIP QA program (e.g., procedure development, establishment of Quality Assurance Level assignments, correction of QA program deficiencies, etc.).
SAFETY	All activities which support existing safety or maintenance programs.
ADMIN	All strictly administrative activities (e.g., planning, budgeting, staffing, space acquisition, reporting, etc.).
SCP PREP	Site Characterization Plan (SCP) preparation.
ESSENTIAL	Activities that are essential for the project to continue or that are imprudent to stop at this time (e.g., actions resulting in delay costs or partial termination costs greater than that required for completion of the activity).

STATE OF WASHINGTON
OFFICE OF THE GOVERNOR

OLYMPIA
98504-0413

BOOTH GARDNER
GOVERNOR

October 31, 1986

Mr. John Herrington
Secretary of Energy
Washington, D.C. 20585

Dear Secretary Herrington:

Over the past several months informal efforts have been made by the Washington State Nuclear Waste Board to obtain information concerning ongoing and planned activities relating to the candidate repository site at Hanford. These efforts have been unsuccessful. Although Department of Energy officials have on several occasions promised to provide answers to our inquiries, they have not been forthcoming.

If any site characterization activities are ongoing, our position is such activities are in violation of the Nuclear Waste Policy Act. We understand the Nuclear Waste Policy Act to require submission of a site characterization plan and the conduct of public hearings on such plan before site characterization activities may be undertaken. Section 113(a) of the Act requires you to consider fully the comments received in public hearings on a site characterization plan. Further, that section requires consultation with the Governor of the affected state in conducting site characterization activities.

Despite these requirements, it appears the Department of Energy and its contractors are proceeding with site characterization activities without consulting the State of Washington and prior to the conduct of public hearings. The serious nature of such noncompliance is illustrated by the attached correspondence between Terry Husseman, Director of our Office of Nuclear Waste Management, and the Richland Operations Office. Your contractor was apparently planning to use radioactive tracers in a flowrate survey until the state's Office of Nuclear Waste Management learned of the plan and intervened. Not only would such activity have violated the consultation and public hearing requirements of the NWPA, but it would also have been in direct contravention of restrictions on the use of radioactive materials contained in section 113(c).

The State of Washington insists upon compliance with the provisions of section 113(a) of the NWPA which require submission of a site characterization plan and the conduct of public hearings before site characterization activities are undertaken. In addition, we formally request response to the following questions pursuant to the State of Washington's right under section 117(a) of the NWPA to receive "timely and complete information regarding determination or plans made with respect to the site characterization... of such repository."

1. Does the Department of Energy intend to conduct any site characterization activities prior to public hearings on a site characterization plan? If yes, how do you intend to comply with the provisions of section 113 of the Act which require you to consider fully comments received in public hearings and to consult with the Governor in conducting site characterization?

2. Have any laboratory or field activities relating to characterization of the Hanford site been conducted from May 28, 1986 to the present? If such activities have been or are being conducted, detail the nature and rationale of the activities, the names and positions of the persons overseeing such activities, and the documents which relate to or were generated as a result of such activities.

3. Please detail the activities included in each project work package referenced on the attached "Table of Project Activities by Work Package" and indicate which activities are exempt from the stop work order issued in May 1986 pertaining to inadequate quality assurance procedures.

4. What laboratory or field activities relating to characterization of the Hanford site are planned to be conducted in the three months following your response to these questions? Please detail the nature of the activities, the purpose of the activities, the dates when such activities will be conducted, the names and positions of the persons who will oversee such activities, and all documents which describe such activities.

5. Please furnish any documents, described in questions 2 and 4, above, developed by your agency or its contractors.

Consistent with the state's right to timely information, we request immediate response to questions 1 through 3 regarding activities which are ongoing or will be undertaken within the next 30 days. Question 4 must be answered within 30 days pursuant to section 117(a)(2) of the Act. Timely and complete answers to the very important requests we make will avoid the necessity for resorting to statutory remedies.

Thank you for your consideration in this pressing matter.

Sincerely,

Booth Gardner
Governor

BG:216p

Enclosures

ANDREA BEATTY RINIKER
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Mail Stop PV-11 • Olympia, Washington 98504-8711 • (206) 459-6000

August 27, 1986

Mr. Lee Olson, Project Manager
Basalt Waste Isolation Project
U.S. Department of Energy
P.O. Box 550
Richland, WA 99352

Dear ~~Mr. Olson~~ Lee:

It has come to my attention that USDOE and Rockwell may soon initiate radioactive tracer and pump tests at well DC 23. If this is true it concerns me because you did not notify us of this activity, and you did not provide the state of Washington timely and complete information regarding this testing as required in Section 117 of the Nuclear Waste Policy Act.

We have not received specific details about your planned testing, but it appears the proposed tracer and pump tests are in conflict with the following:

- Section 113(c) of the Nuclear Waste Policy Act which places specific restrictions on the use of radioactive material during site characterization.
- The agreement made at the May 7 USDOE/States/Tribes meeting and confirmed at the August 13 USDOE/States/Tribes meeting. At both meetings, USDOE agreed not to start new work at federal sites until the states had an opportunity to review the 15-20 page document which describes ongoing work. In addition, USDOE agreed to consult with the states prior to beginning new work.
- The general stop work order issued to Rockwell Operations on May 13, 1986.
- The Hydrologic Test Strategy agreement with NRC and the state of Washington which calls for a consensus on the hydrologic baseline before pump tests are initiated.
- State of Washington water quality and water rights laws and regulations which preclude contamination of groundwaters.

In addition, the need to monitor and differentiate the source of environmental contamination from a repository or from defense wastes was a major comment on the Defense Waste DEIS and the EMMP annotated outline. We are concerned that your use of radioactive tracers, rather than the conventional tracers, may destroy the baseline for radioactive iodine.

Even if these legal and procedural obstacles can be resolved, the state will have continuing strong objections to the use of any radioactive tracer in the basalt aquifers. On many occasions, and most recently in our response to the Defense Waste DEIS, we have expressed concern over the ability to perform postclosure monitoring of releases from a deep repository. Such monitoring would logically be performed at depth and in the aquifers now involved in hydraulic testing. Iodine-131/129, in fact, would be one of the most objectionable radionuclide tracers, since it would occur in the leading edge of a release plume from the repository. It would be essential to postclosure monitoring to have an iodine baseline in each of several aquifers above the repository, and the deliberate introduction of radioiodine today could destroy that baseline. Since there are adequate synthetic organic tracers available, they should be seriously considered for use in any proposed tracer tests. We are available and willing to work with you in the future planning of such tests.

Please provide us with the rationale for and the description of these tests. Thank you for your anticipated cooperation.

Sincerely,

Terry Husseman

Terry Husseman, Director
Office of Nuclear Waste Management

THkc

cc: Warren Bishop

Depart
Richla
Richlan

Mr. Terry Husseman, Program Dir
Office of Nuclear Waste Managem
Washington State Department of
  Ecology, MS PV-11
Olympia, WA 98504

Dear Mr. Husseman:

VELOCITY SHOT TRACER INJECTION

Thank you for your letter of /
tracer logging at borehole DC-

Our contractor (Rockwell) is
a velocity shot tracer survey
developing the appropriate su

The purpose of the proposed s
the borehole. The interval i
3,532 feet. Conventional lo
usable results, as the forma
tracer, I-131, is being cons
half-life.

The current borehole status
Canyon flow to isolate the l
being evaluated. Further t
occur when the Stop Work Or
radioactive tracer logging
time. Radioactive tracer l
certain the activity is con
applicable NRC and Washingt
the appropriate documentat
is used as a radioisotope
including I-129, will not

Although the decision has
logging, the NRC and State
of the study and provided
full rationale and descri

Mr. Terry Husseman

If you have any additional questions on
Mr. M. L. Powell (509-376-5267) of my of
interface on the technical issues as may

Si

BWI:MKT

Jo
f

cc: Mr. Russell Jim, Program Manager
  Yakima Tribal Council
 Mr. Ron Halfmoon, Program Manager
  Nez Perce Tribal Executive Comm.
 Mr. Bill Burke, Program Chairman
  Umatilla Confederated Tribes
 Mr. David Stewart-Smith
  Department of Energy, OR
 Mr. Max S. Power
  Institute for Public Policy, WA
 Mr. Glen Lane
  Council of Energy Resource Tribes
 Mr. Donald Provost
  St. of Wash. Dept. of Ecology

Enclosure 3

OCT 2 4 1988

se contact
l arrange for proper

, Assistant Manager
Nuclear Waste

TABLE OF PROJECT ACTIVITIES
BY WORK PACKAGE

SUMMARY TABLE

to be Stopped		329
Excepted from SWO by Justification*:		
thering Activities	20	
Management Program Support Activities	44	
l Safety and Maintenance Activities	61	
rative Activities	118	
aration Activities	46	
l Activities/Imprudent to Stop	61	
es Require Clarification	141	
ages Excepted from SWO		501
rk Packages		830

itions of the six justifications for excluding work
Stop Work Order are given on Pages 1 and 2 of a
1, 1986, from R. D. Larson to General Manager, Rockwell
ns titled, "Basalt Waste Isolation Project Work Evaluation."

NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS PROJECT
SUMMARY OF ONGOING AND PLANNED SITE CHARACTERIZATION ACTIVITIES FOR THE CANDIDATE SITE AT YUCCA MOUNTAIN, NEVADA

May 1986 - April 1987

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2.0 Introduction 1

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4.0 Planned Site Characterization Activities 11

MARCH 1, 1987

NNWSI PROJECT
SUMMARY OF ONGOING AND PLANNED SITE CHARACTERIZATION ACTIVITIES FOR THE CANDIDATE SITE AT YUCCA MOUNTAIN, NEVADA
May 1986 - April 1987

1.0 Preface

The Nuclear Waste Project Act (NWPA) of 1982 requires that the Department of Energy (DOE) prepare and issue a Site Characterization Plan (SCP) to the Nuclear Regulatory Commission (NRC) and to affected States and Indian Tribes before sinking exploratory shafts (ES) at any candidate sites. While site characterization activities related to the exploratory shaft facility (ESF) will not be initiated until after the issuance of the SCP, some surface - based activities are ongoing or may be initiated before issuance of the SCP.

During the May 7-8, 1986, NRC DOE meeting on the level of detail for site characterization plans and study plans, the DOE agreed to prepare a letter report describing these ongoing and planned site characterization activities for the States and Indian tribes. Ongoing activities are defined as site characterization activities, as defined by NWPA, that were in progress at the time of Presidential Approval (May, 1986). Planned activities are defined as site characterization activities, as defined by NWPA, that have been started, or are planned to be started, after Presidential approval, but before the expected date of SCP issuance (April, 1987).

2.0 Introduction

According to the NWPA of 1982, site characterization refers to those research activities, whether in the field or in the laboratory, that are undertaken to establish the geologic condition and the range of parameters relevant to an evaluation of the suitability of a candidate site. Yucca Mountain became a candidate site on May 28, 1986, with the President's approval of the recommendation by the Secretary of the DOE. This recommendation was accompanied by a final Environmental Assessment pursuant to the NWPA.

Site characterization activities that take place in the field include mapping, geophysical surveys, borings, surface excavations, excavation of exploratory shafts, subsurface lateral excavations and borings, and in situ testing. Laboratory activities include measurement of thermal, mechanical, and hydrological rock properties; analysis of gas and water samples and fossil plant material; detailed mineralogic and petrologic analyses; and geochemical studies under conditions simulating the repository environment. Office activities include modeling and data reduction and analysis. Excavation of an exploratory shaft and in situ testing at the depths of waste emplacement are required by the NRC (10 CFR 60.10(b)), and were described in the DOE Mission Plan.

2.1 The Nevada Nuclear Waste Storage Investigations (NNWSI) Project Site Characterization Plan (SCP).

Site information gathered during the 1978 to 1984 time frame was used to prepare the EA and to evaluate the site against the DOE siting guidelines. Site investigations completed before Presidential approval (May 1986) but not reported in the EA will be described in the SCP, tentatively scheduled for issuance in April 1987.

Data Chapters 1 through 5 of the NNWSI Project SCP will establish the current understanding about the Yucca Mountain site with regard to Geology (Chapter 1), Geoengineering (Chapter 2), Hydrology (Chapter 3), Geochemistry (Chapter 4), and Meteorology and Climate (Chapter 5). Current conceptual designs for the repository and waste package are provided in Chapters 6 and 7, respectively. Results from ongoing studies and design activities available too late for incorporation into the SCP will be reported in the semiannual Progress Reports.

Chapter 8 of the SCP contains a description of plans for site characterization activities. Section 8.1 of the SCP describes the rationale for the planned site characterization program, while Section 8.2 discusses the technical and regulatory issues that are to be resolved during site characterization. Section 8.3 is the Plans section of the SCP and is structured on the basis of Issues and Information Needs, using the NNWSI Project Issues Hierarchy. Section 8.4 describes the plans for site preparation for the surface and subsurface excavations at the exploratory shaft location and a description of the exploratory shaft and underground test facilities. Section 8.5 reviews the milestones and decision points in the site characterization program up to submittal of the license application. Section 8.6 provides a description of the Quality Assurance Program for the Project, and Section 8.7 describes the plans for decontamination and decommissioning of the candidate site if the site is not selected for development as a repository. Enclosure 1 provides a working copy of the structure of Chapter 8.

Details of planned in situ testing in the Exploratory Shaft will be described in the SCP and in Study Plans, which will provide supporting material of the Yucca Mountain SCP.

2.2 The NNWSI Project Issues Hierarchy.

The Issues Hierarchy is the means by which the NNWSI Project has abstracted and organized the repository siting and licensing requirements into a hierarchial structure of Key Issues, Issues, and Information Needs. This hierarchial structure provides a means to distinguish broad questions of overall suitability (Key Issues) from more specific questions (Issues). Some questions in the regulations governing repositories deal with performance objectives or regulatory standards; other questions deal with favorability or standard operating practices and procedures. In addition, some questions in the regulations deal with postclosure time frames, while others only deal with the preclosure period. Key Issues are related to broad technical or institutional requirements pertaining to the performance of the site with respect to compliance with applicable regulations. Issues are subordinate to Key Issues. Collectively, the group of Issues under a Key Issue indicates what questions must be resolved to satisfy the Key Issue. The Issues are also generally readily identifiable as elements of the regulations. Information Needs are subordinate to Issues and identify the specific information, data, and analyses needed to resolve the Issues.

Issues within each Key Issue in the NNWSI Project Issues Hierarchy are grouped into Characterization, Design, and Performance, Issues. The separation of topics according to preclosure and postclosure time frames is automatic, because the Key Issues explicitly make the time frame distinction. Characterization Issues encompass the site characteristics, processes, and events that may affect repository design and performance. They include detailed information on the geologic, hydrologic, and other site characteristics. Design Issues address needs for information about the design of the geologic repository operations area and its associated surface facilities and underground facility. Performance Issues address the analyses necessary to assess the suitability of the Yucca Mountain site and its proposed repository facilities as a licensable repository system. Performance Issues encompass the requirements placed on the behavior of the repository system. Key Issue 3 is not included because it represents the environmental regulatory requirements and Information Needs, and covers monitoring and mitigation efforts. Key Issue 3 will be fully developed after the Environmental Impact Statement (EIS) scoping meetings and hearings are completed.

Information Needs were used as the basis for defining the field and laboratory investigations to be conducted during site characterization. Each Information Need described in Section 8.3 of the SCP will be presented according to a standard format:

1. A list of the data and parameters to be collected to satisfy the Information Need.
2. A discussion of the logic tying the data and parameters together.
3. A description of the studies and activities planned to collect the data and parameters for the Information Need.
4. A discussion of where the data and parameters will be used as input to other Information Needs.
5. A preliminary list of planned milestones and schedules for completion of the activities and studies.

2.3 Purpose

The purpose of this report is to summarize site characterization activities at the candidate site at Yucca Mountain, Nevada, for ongoing activities and the status of planned activities. This summary is provided in response to agreements between the DOE and the NRC resulting from the May 7-8, 1986 meeting. A more comprehensive discussion will follow in the SCP.

This summary concentrates on surface-based activities, which include all field activities defined by the NWPA as site characterization activities (e.g., drilling, drillhole testing and monitoring, trenching, mapping, and surveying at the Yucca Mountain site and surrounding region) that are not directly related to the ESF. Site Characterization activities related to the ES will not be initiated until after the SCP is issued. In addition, prototype testing which is not a part of site characterization, is not included in this summary. Geochemical and thermomechanical laboratory testing related to field activities are described, as well as meteorological studies. A brief technical rationale for each activity is provided, and activities are cross-referenced to the appropriate sections in the SCP.

This report is divided into two sections: ongoing site characterization activities and planned activities.

3.0 Ongoing Site Characterization Activities: Description and Rationale

Site investigation activities were initiated in 1978 when the NNWSI Project began to focus on tuff at Yucca Mountain as a potential repository host rock. The DOE identified Yucca Mountain as a potentially acceptable site in February 1983. Publication of the final EA for the Yucca Mountain site (May 1986) establishes that the site is suitable for site characterization. It is expected that some of the previously initiated activities will continue or be completed during the time between Presidential approval of the site recommendation, and issuance of the SCP. Examples of such activities include seismic monitoring, hydrologic monitoring, meteorologic monitoring, geodetic surveys, and laboratory analyses of degradable and irreplaceable samples. Office activities include modeling and data reduction and analysis of available data. Brief descriptions of each activity are given below.

3.1 Hydrologic Activities.

Various hydrologic activities have been initiated to establish the moisture conditions of the unsaturated zone, and to determine if recharge is episodic or steady-state. Saturated zone activities have been focused on determining the position of the water table, and on establishing the characteristics of fracture hydrology. The following specific activities, including the data reduction and analyses associated with field-data collection, are ongoing.

3.1.1 Seven holes have been drilled to monitor in situ moisture conditions in the unsaturated zone (Figures 1 and 2). These holes range from 400 to about 2,000 feet deep. One of these holes, USW UZ-1, has been fully instrumented and continuously monitors hydrologic properties of the unsaturated zone. Existing holes UZ-4, 5, 6, 6s, 7, and 13 will be instrumented and monitored. Gas samples are also obtained periodically from UZ-1. UZ-8, which was only partially drilled, will be re-entered, drilled to the planned total depth and instrumented. Re-entering any of these holes may be necessary to acquire additional information using geophysical logging tools and other instrumentation. This activity supports the studies identified in section 8.3.1.2.2 of the SCP.

3.1.2 Fourteen boreholes (Figures 1 and 2) were drilled into the saturated zone for the purpose of determining the elevation of the water table at various locations at the site. These boreholes range from about 1,600 to 2,000 feet deep. Water levels in the boreholes are monitored regularly to record fluctuations in water levels as a function of time. Water table levels from the fourteen water table holes were used to establish the hydraulic gradients used to estimate the saturated zone travel times presented in the EA. This activity supports the studies identified in sections 8.3.1.2.1 and 8.3.1.2.3 of the SCP.

3.1.3 Seventy-four neutron holes (depths from 50 to 200 feet) have been drilled in the vicinity of the site to monitor the infiltration of precipitation in various geologic settings. Because of the importance of flux estimates in the unsaturated zone, monitoring data on shallow infiltration is used to determine the upper bounds on flux through the repository horizon. The holes are logged periodically with thermal and epithermal neutron tools, and gamma-gamma tools. The locations of the neutron holes are shown in figures 1 and 2. This activity supports studies identified in section 8.3.1.2.3 of the SCP.

3.1.4 Nine streamflow gages have been installed in dry washes at and near Yucca Mountain to monitor the surface-water runoff that occurs during and after storms. Streamflow gages provide data to be used in predicting the frequency and magnitude of runoff resulting from heavy precipitation events, which are typical in desert environments. This activity supports studies in sections 8.3.1.5.1, 8.3.1.6.1, and 8.3.1.16.1 of the SCP.

3.1.5 Observations of debris-flow movements are being made at the time of occurrence in order to understand the mechanisms of flow and the climatic and other factors that cause them. This effort contributes to the understanding of the conditions under which paleoflood deposits occurred. This activity supports studies identified in sections 8.3.1.5.1 and 8.3.1.6.1 of the SCP.

3.1.6 Channel scour chains have been installed at three locations in the Yucca Mountain area to measure the amount of erosion, or scour, that occurs in washes during times of heavy runoff. Heavy runoff events expose successively deeper parts of the chain, thus giving a measure of the amount of sediment movement in the wash. This activity supports studies identified in sections 8.3.1.5.1 and 8.3.1.6.1 of the SCP.

3.1.7 Water-level and pressure measurements are being recorded continuously in the three UE-25c boreholes (Figure 2), located in Drill Hole Wash, using a continuously recording data logger to evaluate barometric, tidal, and other time-related effects on water levels. This information is used to provide better understanding of fracture porosity and other aquifer properties. Long-term, continuous recording is required in order to obtain an accurate correlation of the atmospheric pressure versus water-level data. This activity supports studies identified in section 8.3.1.2.3 of the SCP.

3.1.8 A mining company is drilling boreholes in the Amargosa Desert as part of its exploration programs. This commercial company have agreed to allow installation of tubing or piezometers in their holes for NNWSI Project data collection purposes. Some tubing and piezometers have been installed to measure water levels in areas adjacent to the Yucca Mountain site in order to provide data for regional hydrologic studies. Additional instruments will be installed if additional holes are made available to the Project. This activity supports studies identified in section 8.3.1.2.1 of the SCP.

3.1.9 Measurements of temperature, precipitation, and infiltration are being made at two recharge sites at Pahute Mesa and near Tonopah that are thought to be analogous to the Yucca Mountain site under pluvial climatic conditions. Temperature of the air and soil are continuously recorded on a data logger. Precipitation samples are collected from samplers and sent to the laboratory for stable isotope analysis. The measurements will aid the estimation of ground water recharge rates at the site under future pluvial conditions. This activity supports studies identified in section 8.3.1.5.1 and 8.3.1.5.2 of the SCP.

3.1.10 Laboratory testing of crushed tuff for hydrologic and other properties is being conducted for evaluation of sealing materials. Although this effort is necessary for work on sealing concepts, it has only an indirect tie to site characterization.

3.1.11 Laboratory measurements of hydrologic properties of existing core and cuttings and water and gas samples are being made to define in situ conditions. Relationships among various hydrologic properties in the unsaturated zone are being identified. This activity supports studies identified in section 8.3.1.2.2 of the SCP.

3.2. Geologic Activities.

The tectonic setting of the Yucca Mountain site is important to its overall suitability as a candidate site. Seismic data and geodetic measurements are both valuable in assessing tectonic setting of the site. The following geologic activities, including the data reduction and analyses associated with field-data collection, are currently ongoing.

3.2.1 Fifty-three seismometers (Figure 3) have been installed in the region around Yucca Mountain as part of a regional seismic network, extending in lines trending east-west from the west side of Death Valley to Caliente, and generally north-south from Tonopah to Lake Mead. The two lines intersect near Yucca Mountain. The seismometers are in continuous operation and data are recorded automatically. Data from the seismic network have been used to establish the earthquake catalog for the region (Rogers et al., 1976, 1983), which is essential for predicting the size and frequency of earthquakes that are possible during the pre-

and postclosure time periods. The ability to accurately locate earthquakes is also very important for establishing the activity of faults near the site. This activity supports studies identified in sections 8.3.1.8.2 and 8.3.1.17.3.

3.2.2 Ground motions are being measured to define aspects of the design basis for the proposed site for surface facilities near Yucca Mountain. Data from surface and downhole measurements will be used to revise approaches to predicting vibratory ground motion for surface and underground facilities. Motions from underground nuclear explosions (UNEs) are analyzed to develop the relationship between earthquakes and UNEs and for prediction of potential ground motion during repository operation. This activity supports studies identified in sections 8.3.1.8.2 and 8.3.1.17.2 of the SCP.

3.2.3 Without accurate benchmarks that are routinely surveyed, it is impossible to establish local rates of vertical or horizontal tectonic movement. Therefore, geodetic survey benchmarks have been permanently installed in and around the Yucca Mountain site in order to monitor present-day tectonic adjustments in the Yucca Mountain area. A 43-mile level line extends from Crater Flat on the west to Rock Valley on the east. A quadrilateral network has been installed across several faults in the immediate vicinity of Yucca Mountain. Biannual resurveys are conducted. These activities support studies identified in sections 8.3.1.8.2 and 8.3.1.17.2 of the SCP.

3.2.4 Determination of soil characteristics for purposes of soil modeling are made on a seasonal basis. These include dust-trap sampling, determining field capacity of soils, and periodic measurements of carbon dioxide and soil gases. The soil modeling is part of the overall climate modeling effort that addresses the effects changing climate may have on the hydrologic characteristics of the site. This activity supports studies identified in section 8.3.1.5.1 of the SCP.

3.2.5 Several trenches (Figure 4) have been excavated as part of the geologic, tectonic, and paleoclimatic studies. These trenches are sampled and mapped on an ongoing basis. Occasionally, it may be necessary to deepen or lengthen existing trenches to collect additional data and to prevent degradation of the trenches. These activities support studies described in sections 8.3.1.5.1, 8.3.1.8.2, and 8.3.1.17.2 of the SCP.

3.2.6 Geologic mapping is continuing in the vicinity of Yucca Mountain as part of the geologic, tectonic and igneous activity studies. This activity includes the collection of samples to provide dates which help to define rates of tectonic and igneous processes. This activity supports studies identified in sections 8.3.1.8.1, 8.3.1.8.2, 8.3.1.17.1 and 8.3.1.17.2 of the SCP.

3.3 Meteorological Activities.

A meteorological monitoring network has been established at the Yucca Mountain site and has been collecting data since December 1985 (Figure 5). Meteorological data is collected at five towers: four are 10 meters high, and one is 60 meters high. The four 10-meter towers continuously measure and record wind speed, wind direction, sigma theta (standard deviation of wind direction for determining atmospheric stability), relative humidity, and temperature. The fifth tower is instrumented at both the 10-meter and 60-meter levels. The data collected at this tower include the data stated above, plus sigma phi (standard deviation of vertical wind speed), net solar and terrestrial radiation, and precipitation.

These meteorological monitoring activities have begun to provide site-specific data for use in repository design studies, and eventually in the radiological safety assessments required by the NRC (10 CFR Part 60). These activities support studies identified in sections 8.3.1.2, 8.3.1.5.1 and 8.3.1.12 of the SCP.

3.4 Geomechanical Activities.

Laboratory testing, data reduction, and data analysis is ongoing for both thermal and mechanical properties. The next phase of planned testing for thermal properties is the determination of heat capacity of samples of the Topopah Spring Member of the Paintbrush Formation. These measurements are required for predicting the behavior of the host rock under the heat load generated by the waste emplaced in the repository. The next phase of planned mechanical measurements includes low-strain-rate testing, which will help determine the proper constitutive relationships for long-term conditions of the repository, and tensile strength testing, which is relevant to certain repository design analyses.

The NNWSI Project is conducting experiments in the G-Tunnel Underground Facility on Rainier Mesa. Although these experiments are not a part of site characterization, they are ongoing field activities that will guide the planning of the ESF and experiments. Therefore, a short description is provided. A principal ongoing effort in G-Tunnel is a mining evaluation experiment. Instrumented boreholes were used to determine mining-induced rock responses, and to develop improved techniques for controlled blasting in welded tuff. In situ stress and the modulus of deformation for welded tuff are also being determined at the G-Tunnel Facility. A thin slot is cut in the tuff and a flatjack is used to pressurize the side walls, moving them back to their original unrelaxed positions. Measurements obtained through these experiments provide useful experience in preparation for similar activities in the welded tuffs at Yucca Mountain.

These activities support thermomechanical studies and testing to establish repository design constraints and considerations described in section 8.3.1.15 of the SCP. These studies are important for establishing the stability of emplacement holes and drifts, particularly with regard to the requirements for retrievability.

Activities related to measurements of rock properties to be used in predictions of long-term behavior of the potential host rock under the heat load generated by the repository support studies described in section 8.3.1.14 of the SCP. These measurements are important for predicting long term rock mass response and fluid migration due to temperature effects and for establishing whether emplacement holes are likely to remain stable during the retrieval period.

3.5 Geochemical Activities.

Geochemistry of the rocks and water in contact with emplaced waste must be established in order to predict possible interactions for use in determining the lifetime of waste containers, and for predicting radionuclide transport if releases occur. The following activities, and the data reduction and analysis associated with them, are ongoing.

3.5.1 Near-Field Activities.

Two types of laboratory activities are being conducted to characterize the expected time- and temperature- dependent conditions in the hydrologic environment immediately adjacent to the waste packages. These investigations are short-term hydrothermal rock-water interaction experiments between samples from the Topopah Spring Member and water from Well J-13, and experiments to determine the rates and mechanisms of dehydration and rehydration of repository near-field rock in response to the expected thermal field generated by the emplaced waste. In addition, experiments are being conducted to measure the rate at which radionuclides released during waste-form tests are picked up by rock wafers and transported through the wafers. These activities support geochemistry studies for characterizing the very near-field waste package emplacement environment identified in section 8.3.4.2 of the SCP. These studies are important for predicting the performance of the metal container, and for establishing expected release rates.

3.5.2 Far-Field Activities.

There are seven laboratory studies being conducted to better characterize geochemical conditions in the far-field. These include dynamic transport, mineralogy/petrology, sorption, natural isotope, ground-water chemistry, solubility, and hydrothermal studies. The first five studies listed involve experimental work using natural samples previously collected from the Yucca Mountain site. The following sections provide a discussion of each of these five studies.

3.5.2.1 Dynamic Transport Experiments.

The objective of the dynamic transport experiments is to determine the rate of movement of radionuclides along potential flow paths from the repository to the accessible environment. Factors under study which may potentially affect rates of movement include diffusion, dispersion, anion exclusion, sorption kinetics, and colloid movement in the flow geometries and hydrologic conditions that are expected to exist at Yucca Mountain. Ongoing transport studies include column experiments using crushed Yucca Mountain tuff, unsaturated solid tuff core, and fractured core. These column studies will provide experimentally determined hydrologic, physical, and chemical parameters needed to determine the rates of movement of various chemical species and aid in the prediction of radionuclide transport. In addition, diffusion experiments are being conducted using tuff wafers and rock beakers made from Yucca Mountain tuff. These experiments support studies described in section 8.3.1.3 of the SCP.

3.5.2.2 Mineralogy-Petrology Activities.

The objectives of the mineralogy-petrology activities are to describe the host rock mineralogy and petrology by establishing the mineralogic and petrographic stratigraphy including the mineralogic variability, and to provide descriptions of rock and fracture-fill petrology and mineralogy along potential transport pathways to the accessible environment. Ongoing activities include (1) studies of the potential for mineral alteration; (2) characterization of the fracture mineralogy using electron microscopy, x-ray diffraction, and radiometric dating on rock samples from cores, outcrops, and trenches; (3) mineral stability studies on clay, zeolites, and glasses that are important to the natural retardation system; and (4) studies of host-rock mineralogy-petrography using samples from drill cores and outcrops. These activities support studies described in section 8.3.1.3.2 of the SCP.

3.5.2.3 Sorption Activities.

The objective of the sorption activities is to provide data as input to the prediction of radionuclide movement from the repository to the accessible environment. Ongoing experiments include batch, crushed tuff column, and circulating column sorption experiments using tuff samples representative of the various mineralogic and stratigraphic characteristics of Yucca Mountain. Sorption coefficients of actinides and other important waste elements will be determined and used to estimate radionuclide retardation. Another sorption task involves studying the effects of microbes on sorption. This task involves determining the growth properties of microbes taken from soil samples collected from drilling locations at Yucca Mountain. Drilling fluids are used as the energy source for microorganism growth. Sorption coefficients of radionuclides on tuff in the presence of microbes will be determined. These activities support studies described in section 8.3.1.3.4 of the SCP.

3.5.2.4 Natural Isotope Chemistry Activities.

The objective of the activities related to natural isotope chemistry is to provide data on infiltration rates at Yucca Mountain. Chlorine-36 to total chlorine ratios are measured in Yucca Mountain soil samples, and changes in the ratio with depth are used to estimate infiltration rates. These activities support studies described in sections 8.3.1.3.1 and 8.3.1.2.2 of the SCP.

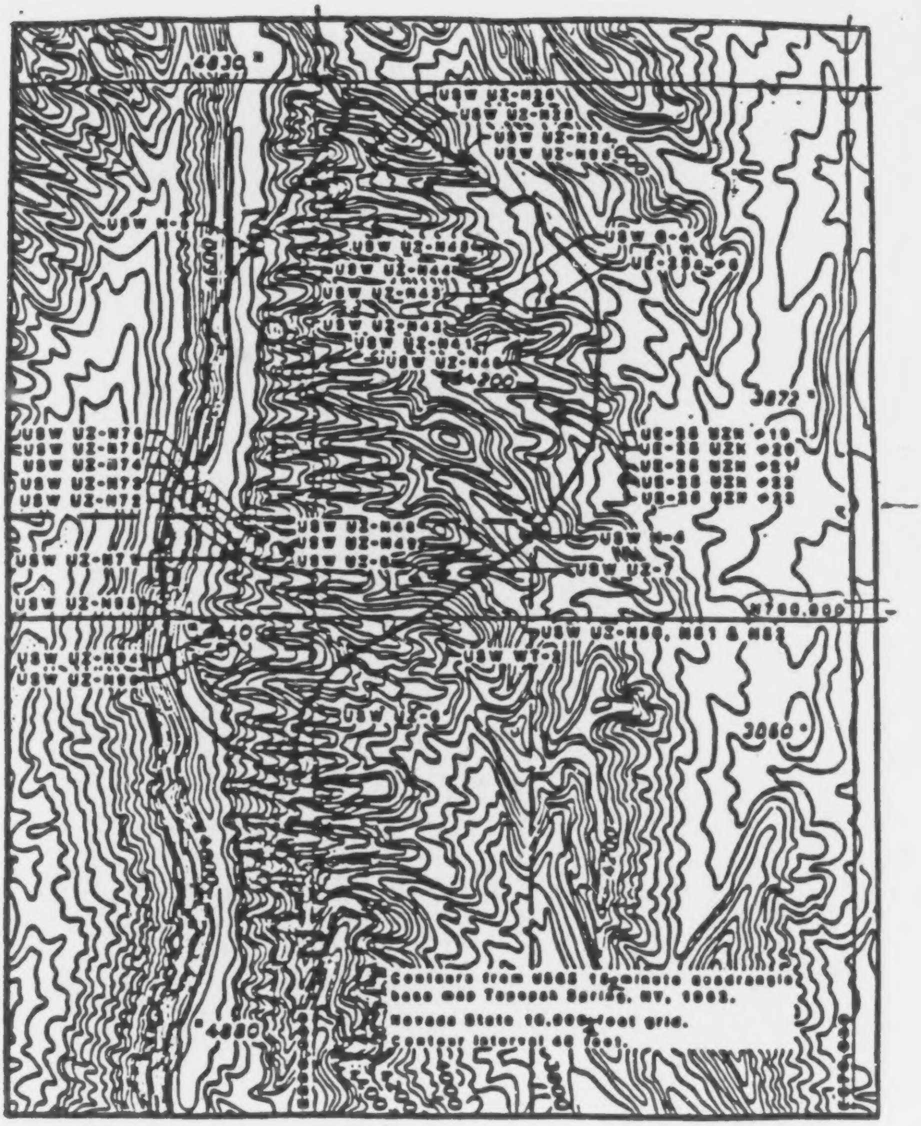
3.5.2.5 Ground Water Chemistry Activities.

The objectives of ground-water chemistry studies are to analyze the composition and the geochemical controls of the composition of pore waters in the unsaturated zone and in the saturated zone in and near Yucca Mountain. The saturated zone water chemistry has been well characterized and samples from Well J-13 are being used in the sorption and dynamic transport geochemistry tasks. Characterization of pore waters from unsaturated zone samples is just beginning. These fluids will be extracted by applying pressure to the core sample, by centrifugation of the crushed core sample, or by vacuum distillation. These activities support studies described in section 8.3.1.3.1 of the SCP.

4.0 Planned Site Characterization Activities

The current schedule for the NNWSI Project assumes that the SCP will be completed in April 1987. At this time, the NNWSI Project does not expect to begin any new site characterization activities prior to issuance of the SCP.

Before any new site characterization activities can be started, the DOE must have appropriate agreements with the Bureau of Land Management for continued land access. DOE must also obtain the necessary environmental permits to comply with all Federal, State, and local environmental requirements during site characterization. In addition, the DOE must prepare study plans in consultation with the State and the NRC.


4830
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USW UZ-N38
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USW H-5
USW G-4
UE-25a-6
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USW UZ-N44
USW UZ-N43
USW UZ-N42
USW UZ-N41
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4200
3872
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USW UZ-N75
USW UZ-N74
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USW UZ-N72
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UE-25 UZN #20
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UE-25 UZN #22
UE-25 UZN #23
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USW UZ-6
USW H-4
USW UZ-7
USW UZ-N71
USW UZ-N58
N760,000
USW UZ-N60, N61 & N62
USW WT-2
USW UZ-N64
USW UZ-N63
USW UZ-8
3860
4880
Contours from USGS 15-minute quadrangle base map Topopah Spring, NV.
Nevada State 10,000-foot grid.
Contour interval 40 feet.

Figure 1. Drillholes located within the outline of the perimeter drift.

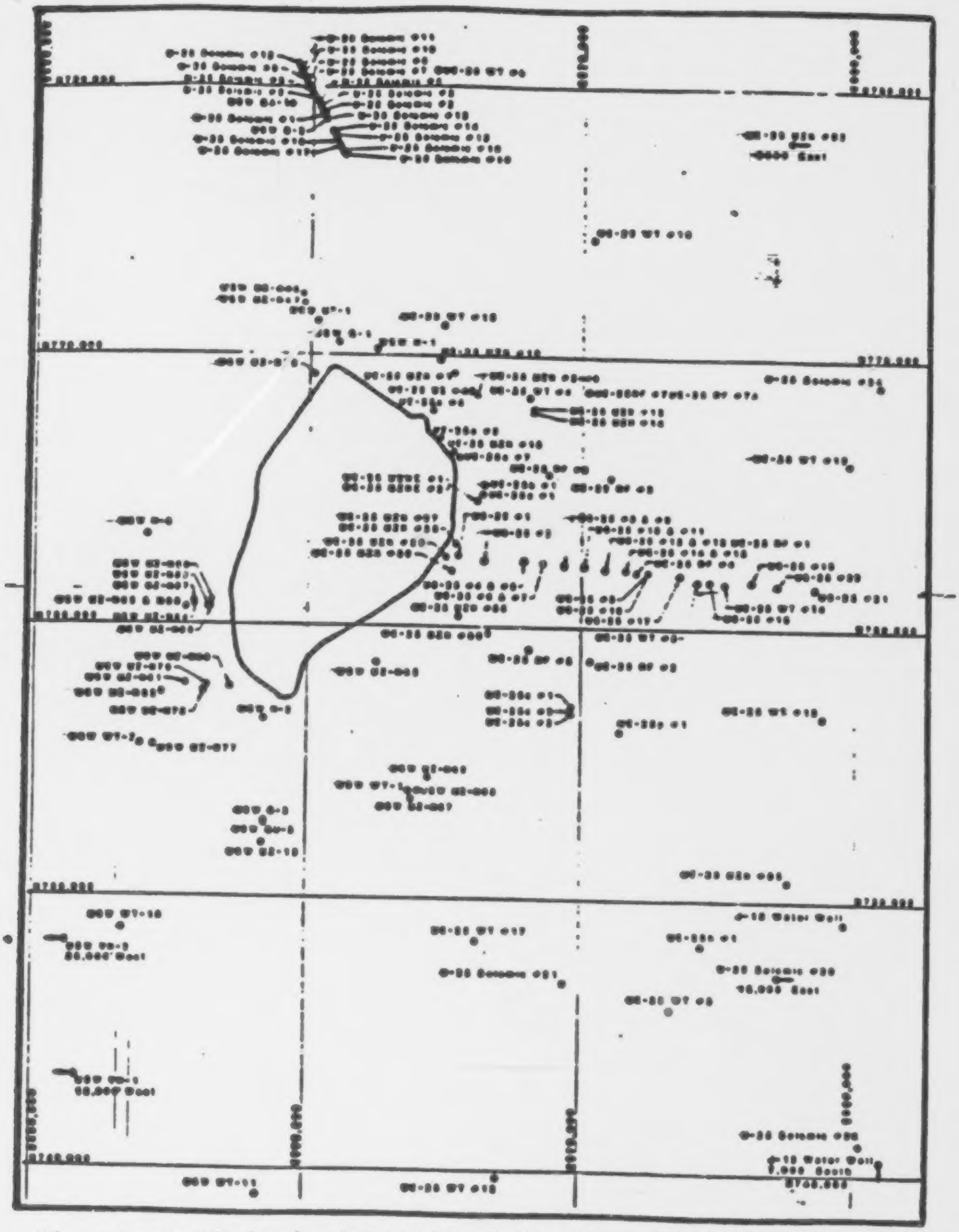

Figure 2. Drillholes located outside of the perimeter drift but within 10km of the perimeter drift.

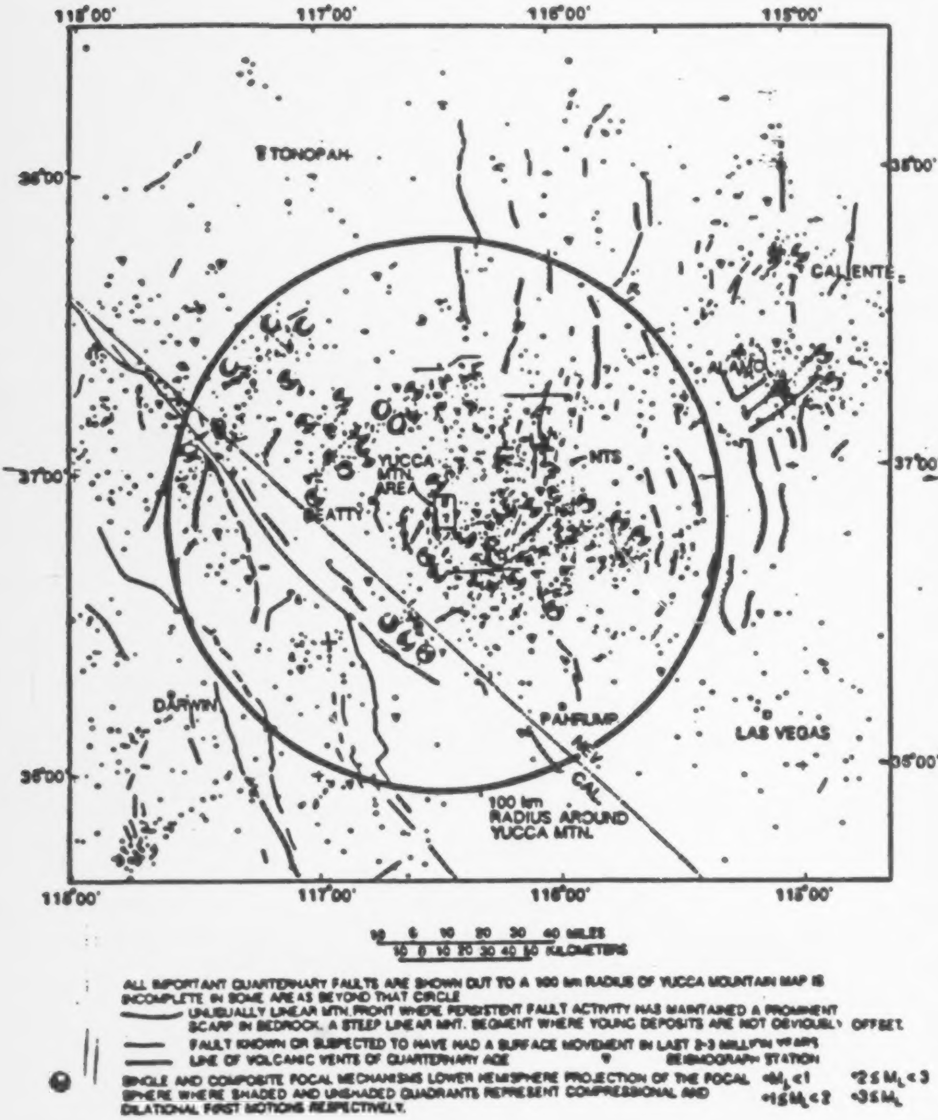
118°00'
117°00'
116°00'
115°00'
38°00'
37°00'
36°00'
TONOPAH
CALIENTE
ALAMO
YUCCA MTN. AREA
BEATTY
NTS
DARWIN
PAHRUMP
LAS VEGAS
NV
CAL
100 km RADIUS AROUND YUCCA MTN.
10 5 0 10 20 30 40 MILES
10 0 10 20 30 40 50 KILOMETERS
ALL IMPORTANT QUARTERNARY FAULTS ARE SHOWN OUT TO A 100 km RADIUS OF YUCCA MOUNTAIN MAP IS INCOMPLETE IN SOME AREAS BEYOND THAT CIRCLE
UNUSUALLY LINEAR MTN. FRONT WHERE PERSISTENT FAULT ACTIVITY HAS MAINTAINED A PROMINENT SCARP IN BEDROCK. A STEEP LINEAR MNT. SEGMENT WHERE YOUNG DEPOSITS ARE NOT OBVIOUSLY OFFSET
FAULT KNOWN OR SUSPECTED TO HAVE HAD A SURFACE MOVEMENT IN LAST 2-3 MILLION YEARS
LINE OF VOLCANIC VENTS OF QUARTERNARY AGE
SEISMOGRAPH STATION
SINGLE AND COMPOSITE FOCAL MECHANISMS LOWER HEMISPHERE PROJECTION OF THE FOCAL SPHERE WHERE SHADED AND UNSHADED QUADRANTS REPRESENT COMPRESSIONAL AND DILATIONAL FIRST MOTIONS RESPECTIVELY.
$M_L < 1$
$1 \le M_L < 2$
$2 \le M_L < 3$
$3 \le M_L$

Figure 3. Regional Map showing locations of the regional seismic network.

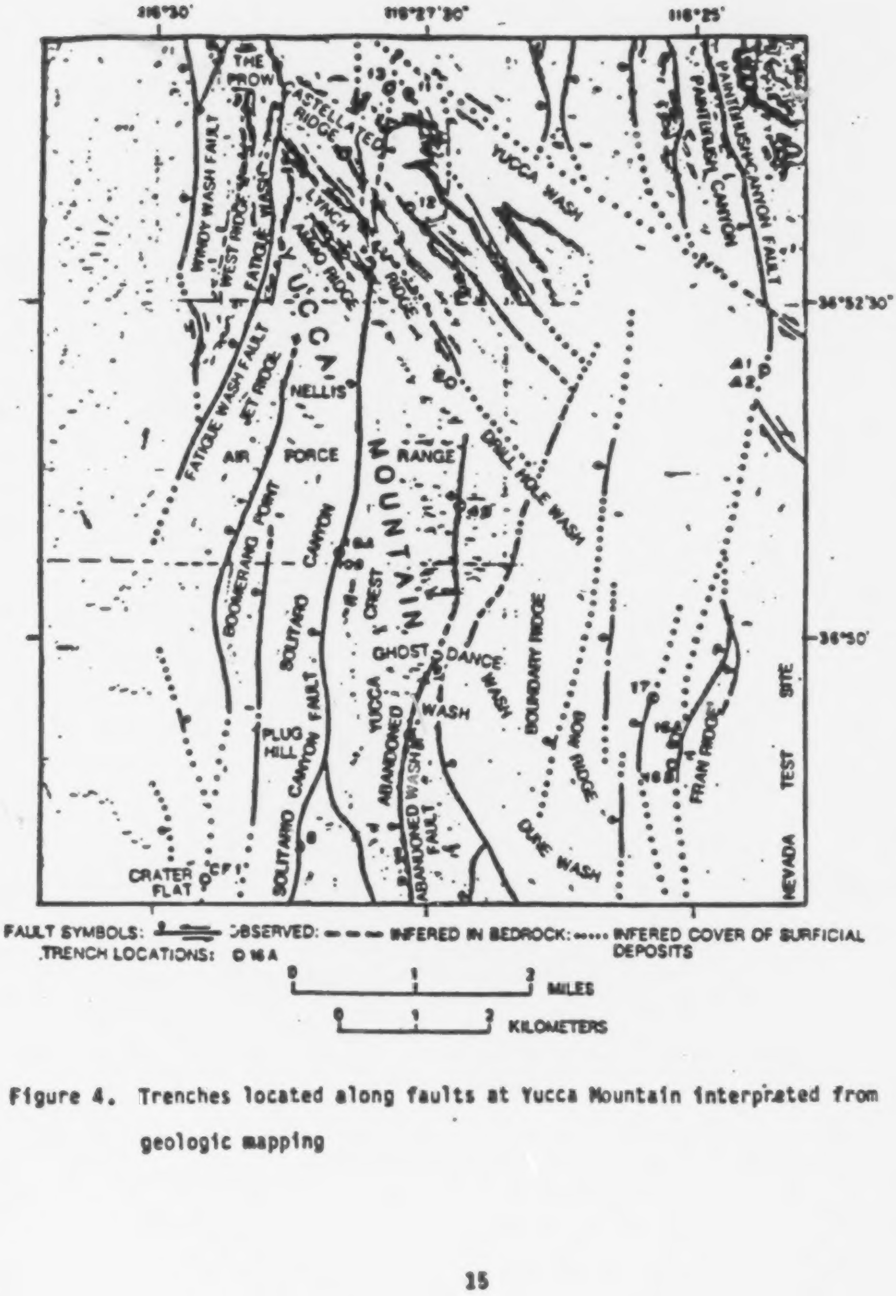
116°30'
116°27'30"
116°25'
36°52'30"
36°50'
THE PROW
CASTELLATED RIDGE
YUCCA WASH
PAINTBRUSH CANYON
PAINTBRUSH CANYON FAULT
WINDY WASH FAULT
WEST RIDGE
FATIGUE WASH
LYNCH
LIVE YUCCA RIDGE
RIDGE
NELLIS
AIR
FORCE
RANGE
FATIGUE WASH FAULT
JET RIDGE
YUCCA
MOUNTAIN
DRILL HOLE WASH
BOOMERANG POINT
SOLITARIO CANYON
CREST
GHOST DANCE
WASH
BOUNDARY RIDGE
BOW RIDGE
PLUG HILL
SOLITARIO CANYON FAULT
YUCCA
ABANDONED WASH
WASH
ABANDONED WASH FAULT
DUNE WASH
FRAN RIDGE
CRATER FLAT
CF1
NEVADA TEST SITE
13
12
A1
A2
17
16A
16
FAULT SYMBOLS:
OBSERVED:
INFERED IN BEDROCK:
INFERED COVER OF SURFICIAL DEPOSITS
TRENCH LOCATIONS:
16A
0
1
2
MILES
0
1
2
KILOMETERS

Figure 4. Trenches located along faults at Yucca Mountain interprated from geologic mapping

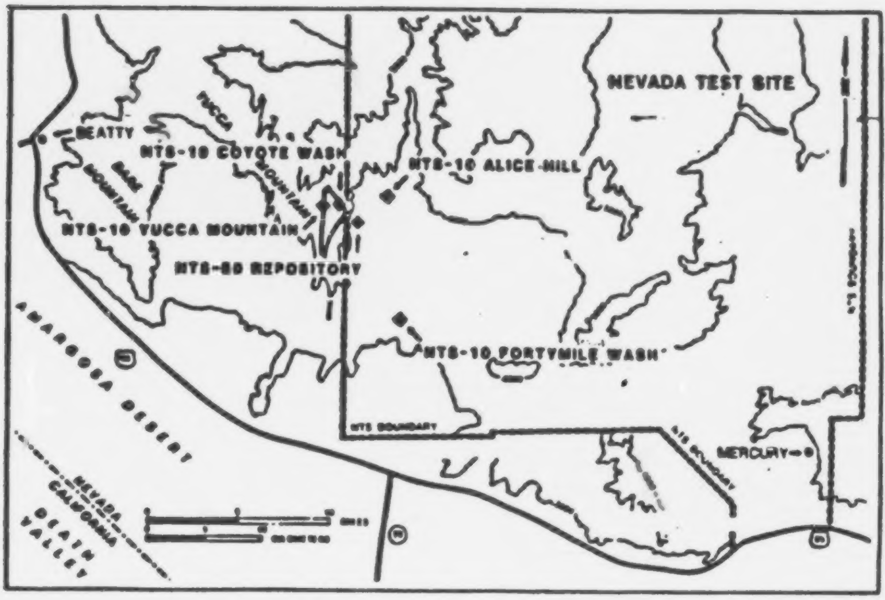
NEVADA TEST SITE
BEATTY
NTS-10 COYOTE WASH
YUCCA MOUNTAIN
BARE MOUNTAIN
NTS-10 ALICE HILL
NTS-10 YUCCA MOUNTAIN
NTS-60 REPOSITORY
NTS-10 FORTYMILE WASH
NTS BOUNDARY
MERCURY
AMARGOSA DESERT
NEVADA
CALIFORNIA
DEATH VALLEY
N

Figure 5. Meteorological monitoring sites

ENCLOSURE 1

1-16-87

REVISED SCP CHAPTER 8 STRUCTURE *

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8.7.2	Decommissioning	
8.7.3	Mitigation	

SCP Section #	Short Title	Issue or IN
8.3.5.20	Techniques Requiring Development	
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RICHARD H. BRYAN
Governor

STATE OF NEVADA

ROBERT R. LOUX
Executive Director

AGENCY FOR NUCLEAR PROJECTS
NUCLEAR WASTE PROJECT OFFICE
Capitol Complex
Carson City, Nevada 89710
(702) 885-3744

November 14, 1986

Mr. Ben Rusche, Director
Office of Civilian Radioactive
  Waste Management
U.S. Department of Energy
1000 Independence Avenue
Washington, DC 20585

Dear Mr. Rusche:

In May 1986, Mr. Ralph Stein of your staff committed to the States/Tribes to issue a report which outlines study plans for field and laboratory activities on-going at the three sites (Hanford, Washington; Yucca Mountain, Nevada; Deaf Smith County, Texas) recommended for site characterization. On June 5 I wrote Dr. Donald Vieth, Director - Nevada Waste Management Project Office, informing him of the Ralph Stein commitment and urged him not to initiate site characterization activities prior to the State's review of the Study plans. At the September Environmental Coordinating Group Meeting Ms. Carol Hanlon of your staff stated that the project study plans were in for Headquarters review and should be ready for issuance to the States/Tribes prior to the end of October.

It is now early November and no study plans have been submitted to Nevada for its consideration. It is my understanding on-going site characterization activities are continuing at the Yucca Mountain site and in contractor's laboratories. It is difficult for me to understand why your office requires over six months to generate a report based upon technical study plans which project Quality Assurance Programs requires to be already in place for on-going field and laboratory activities.

I request you advise me as soon as possible as to why the study plans have not been issued, the schedule for issuing the plans, and why technical plans required by your Quality Assurance Program were not in-place for site characterization activities on-going after the May 28, 1986 decision. The lack of such plans questions the validity of the data for site characterization use.

I would be pleased to discuss this subject with you at any time.

Sincerely,

Robert R. Loux
Executive Director

RRL/CAJ/sjc

cc: Donald L. Vieth, Director
Nevada Waste Management Project Office

Department of Energy
Washington, DC 20585

June 3, 1987

INFORMATION LETTER

Subject: Draft Statement of Work for the Systems Engineering, Development and Management Contractor for the Nuclear Waste Management System, Office of Civilian Radioactive Waste Management, DOE Request for Proposal (RFP) No. DE-RP01-87RW00134

To: Potential Offerors/Respondents

The Department of Energy (DOE) plans to issue a competitive solicitation for the acquisition of a Systems Engineering, Development and Management Contractor for the Nuclear Waste Management System, Office of Civilian Radioactive Waste Management (OCRWM). It is anticipated that this requirement will result in a cost-plus-award-fee Management and Operating contract with Letter of Credit financing provisions. The projected period of performance may include an initial 10-year term, with potential 5-year extensions thereafter.

The DOE wishes to attract industry's highest level of technical and managerial expertise through competition to satisfy this critical requirement. Due to the complex and multifaceted nature of this requirement, the Department is inviting public comments on the enclosed Draft Statement of Work. Those wishing to submit written comments should send them to the following address:

U.S. Department of Energy
ATTN: Document Control Specialist, DE-RP01-87RW00134
Office of Procurement Operations
P.O. Box 2500
Washington, D.C. 20013

All comments must be received no later than June 23, 1987, in order for the Department to take them into its consideration prior to solicitation release.

Finally, all interested parties are invited to attend the Presolicitation Conference for this requirement scheduled on Tuesday, June 16, 1987, at the Department of Commerce Main Auditorium, Herbert C. Hoover Building, 14th Street & Constitution Avenue, NW, Washington, D.C. Registration will begin at 8:00 a.m., and the Conference will be conducted from 9:00 a.m. until 12:30 p.m. (local time).

In conclusion, the objectives of the Department of Energy are to encourage the highest level of competition and select the best qualified contractor with the requisite technical, business, and financial expertise to assume systems engineering, development, and management responsibilities for the Office of Civilian Radioactive Waste Management's Nuclear Waste Management System. DOE looks forward to a strong response from industry on this solicitation.

Aleta Egeland

Aleta Egeland
Procurement Member
Source Evaluation Board

Enclosure

DRAFT

STATEMENT OF WORK

FOR THE

U. S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
SYSTEMS ENGINEERING, DEVELOPMENT, & MANAGEMENT CONTRACTOR
FOR THE NUCLEAR WASTE MANGEMENT SYSTEM

June 3, 1987

DRAFT

STATEMENT OF WORK

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I. INTRODUCTION

A. PROGRAM SUMMARY

The Department of Energy (DOE), through its Office of Civilian Radioactive Waste Management (OCRWM), is responsible for implementing the Nuclear Waste Policy Act (NWPA) of 1982 (Public Law 97-425). This responsibility includes the development of a Nuclear Waste Management System for the ultimate disposal of high-level radioactive waste and spent fuel in a manner that is environmentally acceptable and protects the public health and safety. This Nuclear Waste Management System includes the geologic repositories, transportation systems, and pre-emplacement (e.g., spent fuel rod consolidation), packaging and storage capabilities that may be required.

B. WORKSCOPE SUMMARY

This Statement of Work (SOW) has been prepared for the Systems Engineering, Development, and Management (SEDM) contract for the Nuclear Waste Management System. The SEDM Contractor (hereinafter referred to as "Contractor") is responsible for design and analysis of the Nuclear Waste Management System to ensure that the system is optimized and that the interfaces between the system elements are clearly specified and controlled, including transportation considerations. The Contractor is also assigned specific responsibilities to ensure that the first repository candidate sites are characterized and that the selected site is engineered and deweloped through receipt of an NRC Construction Authorization. The Contractor will provide the strategy options, leadership, and resources to assist DOE in obtaining the Nuclear Regulatory Commission (NRC) licenses. Beyond receipt of the Construction Authorization for the repository, the Contractor is required to perform Title III Design and Inspection and to support DOE and the selected repository operator in obtaining the license to operate the first repository and in preparing for acceptance testing and operations. A primary aspect of the Contractor's responsibilities is to ensure that all work is conducted in a structured and systematic manner that meets the technical, schedule, cost, safety, environmental, quality and interface requirements and that it meets the regulatory requirements of the NRC and Environmental Protection Agency (EPA).

The Contractor is assigned responsibilities for the second repository in areas such as integrating second repository requirements with the other elements of the Nuclear Waste Management System and assisting second repository program participants to comply with the NWPA and ensure techniques, strategy options, design concepts, and plans developed for the first repository are utilized where appropriate and that lessons learned on the first respository are incorporated into second repository planning and implementation.

Should DOE receive Congressional approval for the construction of a Monitored

Retrievable Storage (MRS) facility as part of the Nuclear Waste Management System, the Contractor will be required to provide design and licensing services for the MRS. The Contractor will provide the design and licensing services unless and until DOE makes a decision to transfer detailed design, construction, and operation of the MRS to a separate requirement to be competed. The Contractor would be required to assist in the transition of that workscope to the other contractor. In any event, the Contractor will continue to retain the integration function of the MRS into the overall Nuclear Waste Management System.

The Contractor's responsibilities include integrating the work of various program participants, such as national laboratories, other Federal agencies, and DOE prime contractors conducting work in support of the program. An important aspect of the Contractor's activities is assisting DOE in its interaction with affected States and Indian Tribes to ensure that the consultation and cooperation required by the Act for its successful implementation is achieved. All responsibilities assigned to the Contractor are subject to program authorization and technical direction by OCRWM.

C. STATEMENT OF WORK ORGANIZATION

Following Statement of Work Section I, Introduction, are four additional Sections and three Appendices:

- o Section II provides background information on management of the OCRWM Program, including anticipated organizational roles when the Contractor is performing OCRWM work. Also included in Section II is an overview of the OCRWM Program schedule.
- o Section III describes workscope to be performed by the Contractor with the exception of workscope related to management control system functions. The description of workscope in this section is organized under the OCRWM Work Breakdown Structure (WBS).
- o Section IV describes functions and requirements of management control systems for the SEDM Contract.
- o Section V describes activities during the transition phase when the Contractor is required to prepare for initiation of contract workscope. Section V also outlines the requirements and process for receipt of DOE authorization to begin technical workscope.
- o Appendix A contains acronyms used in this Statement of Work.
- o Appendix B identifies the references cited in this Statement of Work. Unless otherwise indicated, all citations to "Reference" herein refer to Appendix B.

- Appendix C contains a listing of major deliverables to be completed by the Contractor.

II. PROGRAM MANAGEMENT, ORGANIZATION, AND SCHEDULE

This Section provides background information on management of the OCRWM Program, including anticipated organizational roles in relation to the Contractor performing OCRWM work. Also included in this Section is an overview of the Program schedule.

A. PROGRAM MANAGEMENT AND ORGANIZATION

The Program Management System Manual (Reference 1) describes the overall policies and systems for managing the OCRWM Program. In addition to the Program Management System Manual, the Contractor will be required to comply with applicable DOE Orders and management policies and procedures.

1. Program Management Plans and Procedures

Based on the Program Management System Manual and DOE Orders, OCRWM has developed implementing plans and procedures for management of OCRWM Program activities. The key DOE Orders and OCRWM documents necessary for development of the Contractor management control system are referenced in this SOW. The OCRWM management control system requires preparation of baselines and control of work in accordance with baselines. Parts of the OCRWM management system related to licensing contain a feature that quality-affecting work must be conducted in accordance with approved procedures by qualified and trained personnel and must be properly documented. The term quality-affecting refers in general to the quality of items important to safety or important to waste isolation.

It is anticipated that the OCRWM Program Management System Manual and some of the referenced OCRWM documents will be updated by DOE to reflect the new program organization as the Contractor begins work.

2. Program Organizational Responsibilities

Appendix A of the Program Management System Manual lists the overall program organizational responsibilities for the DOE-Headquarters (HQ) OCRWM Offices, DOE Operations Offices and Project Offices, and other DOE Offices that support OCRWM. Although Appendix A of the Program Management System Manual as currently written does not reflect the decision to utilize a SEDM Contractor, it is useful in understanding total program organizational interactions.

The following subsections summarize the anticipated Program organizational responsibilities which will exist when the Contractor begins work. It should be noted that the following subsections are not intended to summarize responsibilities to perform program workscope as these responsibilities are defined elsewhere in this SOW. The following subsections are generally focused on interactions between organizations and are included in the SOW in order to provide a more comprehensive understanding of the extent of capabilities required to perform workscope in this contract. Figures II.1 and II.2 illustrate the current program organization and the planned organization with the Contractor in place.

a. DOE-HQ Organizational Responsibilities

DOE-HQ will continue to perform the management functions described in Appendix A of the Program Management System Manual and will also be assigned responsibility for managing the Contractor. Some of the DOE-HQ staff will be assigned to work closely with the Contractor and it is anticipated that they will be co-located with the Contractor.

As a minimum, DOE-HQ is anticipated to have the following responsibilities:

1) Ensure that the requirements of the NWPA are met.

2) Manage SEDM contract and other DOE-HQ prime contractors.

3) Establish overall Program requirements including those for project management, technical control, quality control, licensing, and institutional activities. Approve implementing plans prepared by Program participants and conduct reviews, audits, surveillances, and assessments to ensure Program participant compliance with requirements.

4) Approve cost, schedule, and technical baselines and changes proposed by the Contractor and other Program participants.

5) Assign workscope and provide budget baseline guidance and direction to all Program participants.

6) As licensee for repositories and MRS if approved, submit license applications to NRC and provide overall assurance that licensing requirements are met.

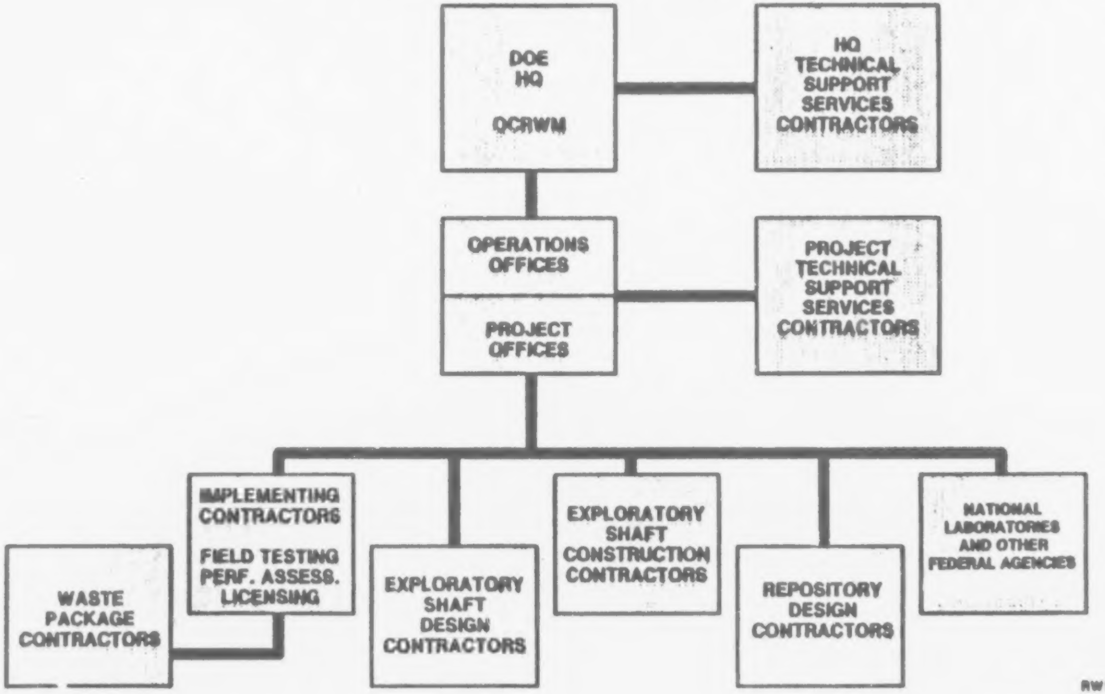
7) Serve as point of contact with Congress, NRC, and other Federal agencies.

b. SEDM Contractor Organizational Responsibilities

Perform work as assigned by this SOW and DOE-HQ direction. As a minimum, it is expected that the Contractor will establish an office to conduct work in the Washington D.C. metropolitan area, and site offices at each of the three candidate first repository sites, in addition to any central work office the Contractor would utilize that is not located at one of those four locations. If the MRS is authorized by Congress, and the Contractor provides MRS design and licensing services, it is expected that the Contractor will establish a site office at the MRS site.

In doing so, the Contractor is required to interact with other Program participants as follows:

FIGURE II.1
CURRENT PROGRAM ORGANIZATION
- FIRST REPOSITORY -

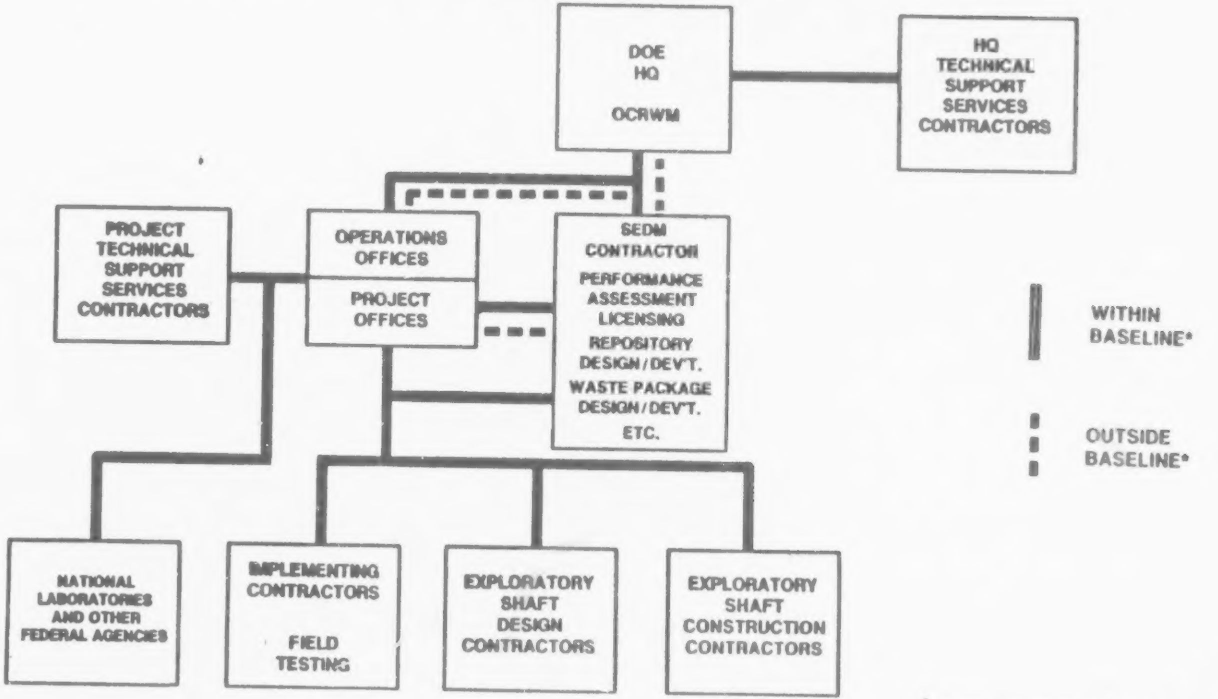

DOE
HQ
OCRWM
HQ TECHNICAL SUPPORT SERVICES CONTRACTORS
OPERATIONS OFFICES
PROJECT OFFICES
PROJECT TECHNICAL SUPPORT SERVICES CONTRACTORS
IMPLEMENTING CONTRACTORS
FIELD TESTING
PERF. ASSESS.
LICENSING
WASTE PACKAGE CONTRACTORS
EXPLORATORY SHAFT DESIGN CONTRACTORS
EXPLORATORY SHAFT CONSTRUCTION CONTRACTORS
REPOSITORY DESIGN CONTRACTORS
NATIONAL LABORATORIES AND OTHER FEDERAL AGENCIES

RWS16307.04

FIGURE II.2

PLANNED PROGRAM ORGANIZATION

- FIRST REPOSITORY -


DOE
HQ
OCRWM
HQ TECHNICAL SUPPORT SERVICES CONTRACTORS
PROJECT TECHNICAL SUPPORT SERVICES CONTRACTORS
OPERATIONS OFFICES
PROJECT OFFICES
SEDM CONTRACTOR
PERFORMANCE ASSESSMENT
LICENSING
REPOSITORY DESIGN/DEV'T.
WASTE PACKAGE DESIGN/DEV'T.
ETC.
WITHIN BASELINE*
OUTSIDE BASELINE*
NATIONAL LABORATORIES AND OTHER FEDERAL AGENCIES
IMPLEMENTING CONTRACTORS
FIELD TESTING
EXPLORATORY SHAFT DESIGN CONTRACTORS
EXPLORATORY SHAFT CONSTRUCTION CONTRACTORS

* TECHNICAL, SCHEDULE, AND BUDGET

1) Contractually and technically report to DOE-HQ.

2) Consistent with DOE-approved baselines and as required to conduct work or execute assigned responsibilities, provide technical, schedule, and budget direction to contractors performing work on the first repository. Direction (within established baselines) will be provided to contractors, and the SEDM site offices, with parallel information provided to the DOE Project Offices with the exception of direction provided to DOE national laboratories or other Federal agencies, which must pass through the Project Office to the national laboratory or other Federal agency. Direction proposed by the Contractor that is outside of the established baseline requires OCRWM approval of a baseline change prior to implementation. Submit first repository deliverables required by this SOW and DOE-HQ direction to DOE-HQ.

3) For MRS Project workscope, submit deliverables to and implement direction transmitted by the DOE MRS Project Office.

4) For Nuclear Waste Management System design and integration, submit deliverables to DOE-HQ and implement DOE-HQ direction. Request input from program participants in performing Nuclear Waste System studies and evaluations. Coordinate recommended changes to the OCRWM Nuclear Waste Management System baseline and interfaces with all potentially affected program participants. Ensure that all program participants are promptly notified of all changes to the baseline and interfaces and are working to the approved baseline and interfaces.

5) For transportation-related workscope, implement direction from DOE-HQ and submit evaluations and studies to them for approval. Coordinate evaluations of proposed transportation baseline changes with the appropriate organizations responsible for transportation subelements. Ensure that all organizations with transportation interfaces or responsibilities are promptly notified of all changes to the baseline and are working to the approved baseline.

6) In support of DOE-HQ, conduct quality assurance reviews, assessments, audits, and surveillances of participants in order to ensure that other Program contractor deliverables are adequate. Recommendations by the Contractor regarding the need for corrective action in the work of other contractors must be provided for implementation to the DOE office that manages the contractor.

7) Provide OCRWM-approved program technical and schedule baseline information to the second repository program participants, and other DOE field organizations managing contractor activities that are OCRWM Program activities but neither assumed by the Contractor nor part of specific project activities.

8) As directed by DOE-HQ, assist DOE in interactions with NRC, other Federal agencies, affected States and Indian Tribes, and the public.

c. First Repository Project Offices Organizational Responsibilities

The salt, basalt, and tuff DOE Project Offices will manage activities remaining with existing contractors consistent with baselines approved by DOE-HQ. For work performed by Project Office contractors under WBS elements assigned to the Contractor, work will also be managed consistent with technical, schedule, and budget requirements established by the Contractor. Proposed budgets prepared by the first repository Project Offices will be submitted to DOE-HQ and will be consistent with technical, schedule, and budget direction established by the Contractor. Technical, schedule, and budget direction provided to Project Office contractors will be reviewed by the Project Offices to ensure consistency with contracts, approved baselines, and the budget provided by DOE-HQ. The repository Project Offices will be required to revise their management systems consistent with the new program organization and to support the transition of work from their contractors to the Contractor, as appropriate.

d. MRS Project Office Organizational Responsibilities

If the MRS is approved by Congress, the MRS Project Office will manage activities consistent with baselines approved by DOE-HQ. The MRS Project Office will establish requirements for MRS design and licensing and will provide these requirements to the Contractor. The MRS Project Office will continue to be responsible for MRS project management including development of the overall project schedule with input from the Contractor.

e. Other DOE Operations Offices Organizational Responsibilities

The second repository program field organization, and the DOE field organizations managing contractor activities that are not assumed by the Contractor will continue to receive budget and technical direction from DOE-HQ. The Contractor and these field organizations and their contractors will exchange OCRWM approved program technical and schedule baseline information to ensure proper integration of all OCRWM program activities.

f. Contractors Performing Other OCRWM Workscope Organizational Responsibilities

Based on DOE-HQ direction, DOE Contracting Officers will on a case-by-case basis revise workscope and responsibilities of existing contractors performing OCRWM workscope. The anticipated transition of responsibilities is summarized in Section V. There is no anticipated change in assignment of management of contracts from one DOE office to another.

B. PROGRAM SCHEDULE

A Draft Mission Plan Amendment (Reference 2) has been submitted to States, affected Indian Tribes, and Federal agencies for their review prior to transmittal to Congress. The Draft Mission Plan Amendment contains a summary report on progress to date in the OCRWM Program and draft milestones proposed by DOE for conducting the remainder of the Program.

The schedule for the first repository from the Draft Mission Plan Amendment is shown in Table II.1. Note that the "current" schedule shown is a proposed revision to the June 1985 Mission Plan and is subject to change based on Congressional feedback.

The key milestones listed on the Table were developed using input from each first repository project office. The schedule remains aggressive and success-oriented. Important assumptions which if changed could impact these milestones are included in the Draft Mission Plan Amendment.

The key milestones for the MRS Project are shown in Table II.2. This schedule, based on the MRS Submission to Congress (Reference 3), is shown in terms of months after Congressional authorization.

The key milestones for the Transportation Program are shown in Table II.3. The Transportation Program schedule, based on the Draft Mission Plan Amendment, is designed to have an adequate operational transportation system available when required to serve the Nuclear Waste Management System.

TABLE II.1

Schedule for the first repository[a]

Milestone	Current schedule	1985 Mission Plan schedule
Start of exploratory-shaft construction		
Tuff	Second quarter 1988	Third quarter 1986
Basalt	Third quarter 1988	Third quarter 1986
Salt	Fourth quarter 1989	Third quarter 1987
Start of in-situ testing		
Tuff	Fourth quarter 1989	Third quarter 1988
Basalt	First quarter 1992	Fourth quarter 1988
Salt	Fourth quarter 1991	Second quarter 1989
End of site characterization *		
Tuff	First quarter 1992	Third quarter 1989
Basalt	First quarter 1993	Third quarter 1989
Salt	First quarter 1993	Third quarter 1989
Draft environmental impact statement	Fourth quarter 1993	Third quarter 1990
Final environmental impact statement	Fourth quarter 1994	Fourth quarter 1990
Submittal of the site-selection report to the President	Fourth quarter 1994	First quarter 1991
Submittal of the license application to the Nuclear Regulatory Commission	First quarter 1995	Second quarter 1991
Receipt of a construction authorization from the Nuclear Regulatory Commission	First quarter 1998	Third quarter 1993
Start of construction	First quarter 1998	Third quarter 1993
Start of phase 1 operations	First quarter 2003	First quarter 1998
Start of phase 2 operations	Second quarter 2006	First quarter 2001

[a] The schedule is given in calendar-year quarters.

* End of the testing necessary for the selection of the repository site and the preparation of the draft environmental impact statement.

SOURCE: Reference 2

TABLE II.2

MRS FACILITY PROJECT SCHEDULE

MILESTONE	CURRENT SCHEDULE
Congressional approval	0
Start design	7 months
Complete license application design	26 months
Complete safety analysis report	27 months
Complete environmental documentation	29 months
Submit license application to NRC	30 months
Receive NRC license	59 months
Begin site preparation	59 months
Complete construction	110 months
Complete operational demonstration	123 months
*Start facility operations	123 months
Start full-scale operations	138 months

*The shipment of spent fuel to the MRS is contingent upon receipt of a Construction Authorization for the first repository. According to the revised first repository schedule in the Draft Mission Plan Amendment, such authorization is expected by the first quarter of 1998.

TABLE II.3

TRANSPORTATION PROGRAM SCHEDULE

MILESTONE	CURRENT SCHEDULE[a]
Award first cask development contract (from-reactor cask)	Third quarter 1987
Issue transportation system requirements and description document	Fourth quarter 1987
Issue draft comprehensive transportation plan	Third quarter 1988
Complete management configuration study	Third quarter 1988
Complete final cask designs	Second quarter 1990
Initiate conceptual design for cask maintenance facility	1990
Issue operating plan	1990
Cask prototypes available	1994
Initiate acquisition of service contractor for operations	1994
Begin cask fleet fabrication	1996
Begin construction of cask maintenance facility	1996
Begin operations	1998

[a] The schedule is given in calendar-year quarters.

III. DESCRIPTION OF WORK

A. INTRODUCTION

This Section describes the workscope to be performed by the Contractor with the exception of workscope related to management control system functions. Management control system functions and requirements are in Section IV. Specific direction will be provided by DOE.

B. OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT PROGRAM WORK BREAKDOWN STRUCTURE

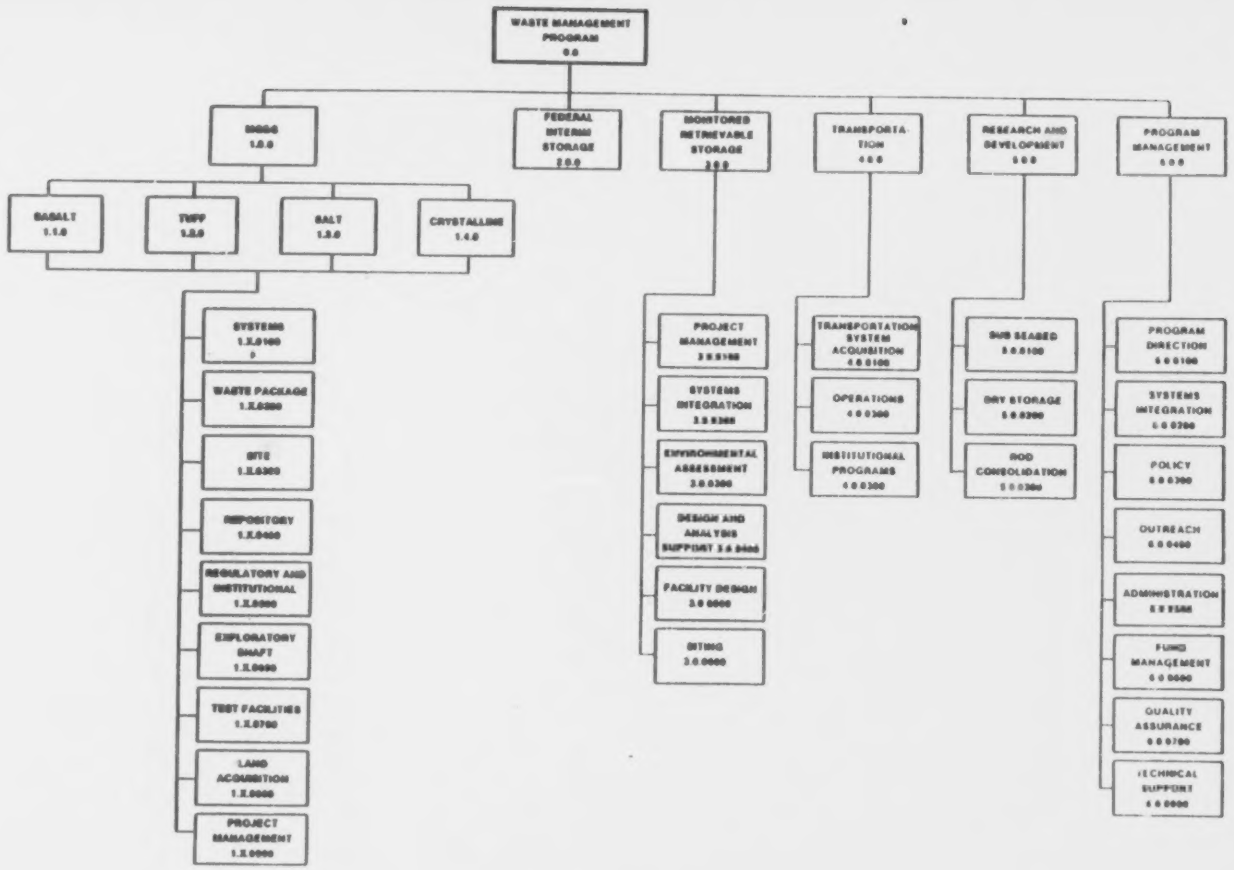
The description of workscope in Section III.C is organized under the OCRWM Work Breakdown Structure (WBS). (A work breakdown structure is a formalized method for subdividing activities into manageable segments and defining each of these so that work can be planned, scheduled, costed, and executed. For more information on DOE use of work breakdown structures, see Reference 4). For the purpose of completeness in providing a comprehensive description of SEDM Contract workscope, Section III.C includes the entire top level OCRWM WBS. Where there is no Contractor workscope under a WBS element, Section III.C states that the Contractor is not responsible for that WBS element.

Figure III.1 shows the OCRWM top-level WBS (Reference 1). Level 0 of the WBS is the end product, which, for the Program, is the Nuclear Waste Management System. Level 1 consists of the four system elements as well as research and development activities and Program management. The system elements are the Mined Geologic Disposal system (1.0.0); Federal interim storage (2.0.0); Monitored Retrievable Storage (3.0.0) which has been proposed to Congress; and transportation (4.0.0). Level 2, currently only used in the repository program, identifies the host rocks: basalt (1.1.0), tuff (1.2.0), salt (1.3.0), and crystalline rock (1.4.0). Note that since the May, 1986 DOE announcement to defer the second repository siting program, the "crystalline rock" activity (1.4.0) is now referred to as the "repository technology development" program. Frequently in this SOW, a designation such as 1.X.02 will be used where the X denotes that work for all three first respository candidate sites is included.

For the repository program WBS elements, a Work Breakdown Structure Dictionary (Reference 5) was issued by the Office of Geologic Repositories (OGR) for use by all repository program participants during the repository development and evaluation phase. This WBS Dictionary defines levels three and four of the repository WBS.

C. WORKSCOPE DESCRIPTION BY WORK BREAKDOWN STRUCTURE ELEMENT

The Contractor has the responsibility to ensure that all work is conducted in a structured, systematic, and controlled manner that meets the regulatory requirements of the NRC and the EPA; DOE requirements for environmental


WASTE MANAGEMENT PROGRAM 0.0
MGDS 1.0.0
FEDERAL INTERIM STORAGE 2.0.0
MONITORED RETRIEVABLE STORAGE 3.0.0
TRANSPORTATION 4.0.0
RESEARCH AND DEVELOPMENT 5.0.0
PROGRAM MANAGEMENT 6.0.0
BASALT 1.1.0
TUFF 1.2.0
SALT 1.3.0
CRYSTALLINE 1.4.0
SYSTEMS 1.X.0100
WASTE PACKAGE 1.X.0200
SITE 1.X.0300
REPOSITORY 1.X.0400
REGULATORY AND INSTITUTIONAL 1.X.0500
EXPLORATORY SHAFT 1.X.0600
TEST FACILITIES 1.X.0700
LAND ACQUISITION 1.X.0800
PROJECT MANAGEMENT 1.X.0900
PROJECT MANAGEMENT 3.0.0100
SYSTEMS INTEGRATION 3.0.0200
ENVIRONMENTAL ASSESSMENT 3.0.0300
DESIGN AND ANALYSIS SUPPORT 3.0.0400
FACILITY DESIGN 3.0.0500
SITING 3.0.0600
TRANSPORTATION SYSTEM ACQUISITION 4.0.0100
OPERATIONS 4.0.0200
INSTITUTIONAL PROGRAMS 4.0.0300
SUB SEABED 5.0.0100
DRY STORAGE 5.0.0200
ROD CONSOLIDATION 5.0.0300
PROGRAM DIRECTION 6.0.0100
SYSTEMS INTEGRATION 6.0.0200
POLICY 6.0.0300
OUTREACH 6.0.0400
ADMINISTRATION 6.0.0500
FUND MANAGEMENT 6.0.0600
QUALITY ASSURANCE 6.0.0700
TECHNICAL SUPPORT 6.0.0800

Program summary work breakdown structure

FIGURE III.1

OURCE: Reference 1

NOTE: 1.4.0 is now called "Repository Technology Development"

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protection, safety, and health; OCRWM quality requirements; and technical, schedule, and cost baselines. The Contractor shall also assist DOE in ensuring that the requirements of the NWPA are met.

It is anticipated that Contractor interactions with other Program participants will occur as described in Section II. Specific agreements on these interactions will be established in the Contractor Project Management Plan, Systems Engineering Management Plan, and Quality Assurance Plan, all of which are approved by DOE-HQ.

1. MINED GEOLOGIC DISPOSAL SYSTEM (MGDS)

a. First Repository

Workscope described in this element of the OCRWM WBS applies to all three candidate first repository sites (Deaf Smith, Texas - salt host rock; Yucca Mountain, Nevada - tuff host rock; and Hanford, Washington - basalt host rock). Where applicable, workscope deliverables specific to any of the individual sites are identified on the list of major contract deliverables (Appendix C).

Although DOE will be the licensee for the first repository and therefore has the ultimate responsibility to ensure that NRC licensing requirements are met, the Contractor shall ensure that all deliverables prepared by the Contractor and other contractors will meet NRC licensing requirements during site characterization, design through Title III, and licensing processes. The Contractor shall also provide licensing support as required to DOE and the first repository operating contractor in preparing for an operating license.

For field-related site characterization work, such as surface-based borehole drilling and testing, geophysical testing, rock mechanics, in-situ testing, waste package environmental testing and for field-related environmental and socioeconomic work, the Contractor shall interact with and utilize existing project contractors. The Contractor will identify plans and data requirements in conjunction with DOE. The project contractors will prepare implementing plans and procedures, generate/collect the data, perform preliminary analyses (i.e., [illegible] quality of the data, evaluate [illegible] against data requirements and study plans, and draw preliminary conclusions), provide data reports to the Contractor, and provide support as requested by the Contractor in data interpretation and performance and design analyses that utilize the data. The Contractor will utilize the data in design of the repository and in performance analyses to reach conclusions for each of the individual sites on comparisons to siting criteria.

The Contractor is also responsible for the conduct of other work that is not field-related site characterization work, such as waste form testing; waste package materials interaction testing; waste package design and development; repository equipment, instrumentation, and seal materials development and testing; and repository and seals design. The Contractor shall utilize, to the extent that it is effective and efficient, the existing cadre of Program participants such as the DOE national laboratories, other DOE laboratories and operating contractors, and other Federal agencies to carry out the work or assist in performance of work. This especially applies to testing activities where facilities, equipment, and trained staff are available or can be made available and to activities related to numerical modeling and performance analyses. In work planning, the Contractor will consider existing DOE contractor capabilities that are or can be made available. In reviewing and approving work plans and other planning, DOE-HQ will have the ultimate authority to make work assignments.

Workscope for first repository Mined Geologic Disposal System is as follows:

1.X.0100 MGDS Systems

The Contractor will be responsible for performing MGDS systems workscope including:

1) Management and Integration

- Provide overall management of the systems activities including planning, scheduling, budgeting, and reporting.

- Provide for interaction and coordination with other OCRWM participants in the systems area.

2) Systems Engineering

- Serve as secretary to the OGR Change Control Board (CCB) (Reference 6) and maintain its records. Provide current system baseline information to Program participants.

- Review the existing MGDS Generic Requirements Document (Reference 7). Provide, for DOE approval, recommendations for changes to the Generic Requirements Document as necessary to control the overall MGDS technical baseline. Maintain the Generic Requirements document as the overall MGDS technical baseline. Evaluate proposals for changes to the Generic Requirements Document and other technical baseline documents and submit recommendations to the OGR Change Control Board.

- Review the existing site-specific system requirements documents and system description documents for each candidate repository in terms of consistency with the MGDS Generic Requirements, adequacy for design, and appropriate identification and control of interfaces. Make changes as necessary and maintain the site-specific system requirements documents and system description documents consistent with the SEDM Systems Engineering Management Plan (SEMP) (see Section IV.C.) and the MGDS Generic Requirements Document.

- Provide analyses of technical issues that affect the mined geologic disposal system and other OCRWM system elements interfacing with the repository.

- Perform risk assessments, system optimization studies and analyses of cost and schedule impacts. The Contractor shall ensure that adequate system studies addressing the rationale for program requirements and trade off studies relative to the implementation of actions to address the requirements are planned, conducted and documented at the appropriate times to support the program schedule. Recommend actions concerning program costs and schedule.

- Evaluate existing models and develop new models (as needed) and estimates for the life-cycle costs of the repository system element.

- Develop, maintain and operate the program's Configuration Management System consistent with requirements in the SEMP. Conduct configuration audits and develop interface controls throughout the program.

3) Technical Data Base Management

- Establish (as needed) and maintain technical data base management systems for use in evaluating waste isolation system performance, including activities necessary to ensure data documentation, traceability and control. Provide for access to the data base system by outside agencies.

- Incorporate existing data into the data base management system through assistance from each candidate repository site and incorporate new data into the system.

4) MGDS Total System Performance Assessment

- Consistent with regulatory requirements for overall waste isolation, conduct performance assessments and develop performance allocation utilizing input from waste package, site and repository performance assessment activities. Conduct and manage pre-closure safety analyses of the overall repository waste isolation system.

- Develop (as needed), verify, validate, benchmark, and document tools for assessing the overall waste isolation performance. Identify and prioritize data requirements for the total performance assessment of the repository system element.

1.X.0200 Waste Package

The Contractor shall be responsible for developing and implementing overall strategies and test programs, and conducting the design, analysis and performance demonstration necessary to produce a waste package capable of meeting the requirements specified by the NRC and that is consistent with the Nuclear Waste Management System. The activities to be performed by the Contractor include, but are not limited to, the following:

1) Management and Integration

- Provide management of waste package activities including planning, scheduling, budgeting, controlling, and reporting.

- Using input from each of the three candidate repository sites, provide overall waste package planning and prepare a strategy and schedule for waste package activities for each site.

- Provide for interaction and coordination with other OCRWM program participants on waste package activities.

- Provide technical expertise in material sciences, chemistry, engineering, and other disciplines as required to evaluate and implement the waste package strategies of each site in meeting regulatory requirements. Assist DOE by obtaining consultants and outside technical expertise for specialized technical reviews and peer reviews.

- Provide study plans for the technical direction of participants to implement necessary site characterization activities in the various waste package disciplines listed above.

2) and 3) Waste Package Environment and Waste Form and Materials Testing

- Provide technical direction to each project in terms of identifying test data needs in the characterization of the waste package environment under both anticipated and unanticipated conditions.

- Evaluate adequacy of each project's waste package environment test plans and procedures in providing data for waste package design and licensing analyses.

- Develop and implement test plans related to the following waste form and materials testing areas utilizing project input:

  a. behavior and radionuclide release rates and mechanisms for spent fuel, commercial high-level waste, and other waste forms.

  b. behavior and corrosion rates and corrosion mechanisms of the waste container and its interaction with the surrounding environment.

  c. behavior of packing materials and host rock.

- Implementation and evaluations of test plans shall take into account that existing facilities engaged in current testing or other DOE facilities which can be made available are to be given consideration for any testing activities.

- Evaluate existing mathematical models and plans for developing new models required to characterize the waste form and waste package environment at each site, and analyze waste package behavior. Provide recommendations to DOE on the need for development of new models, the contractor which should develop each model, and the schedule for model development. Ensure that all mathematical models have been benchmarked and are documented and controlled.

- Utilizing test data, perform analyses with models or provide technical direction to others to perform analyses with models to provide data for waste package performance assessment.

- Provide assistance to DOE in managing the waste acceptance process (Reference 8) for high-level waste (HLW). Provide recommendations for updating existing HLW acceptance specifications and develop for DOE approval new HLW waste acceptance specifications for future HLW producers. Ensure such specifications reflect both repository requirements as well as other OCRWM system requirements, such as transportation. Evaluate waste acceptance compliance plans and waste qualification reports prepared by HLW producers. Coordinate waste acceptance issues with HLW producers.

4) Design, Fabrication, and Prototype Testing

- For each site, review the waste package site characterization plan (SCP) conceptual design, all waste package design studies performed subsequent to completion of the SCP conceptual design, and waste package system requirements documents. Based on reviews, identify additional studies that should be performed prior to or during Advanced Conceptual Design and recommend changes, if necessary, to the site-specific system requirements or subsystem design requirements documents.

- Maintain the waste package subsystem design requirements documents consistent with the site-specific system requirements document and the MGDS Generic Requirements Document. Evaluate proposals to change the waste package subsystem design requirements documents and submit recommendations to the DOE Change Control Board.

- Complete the waste package container standard for design and fabrication.

- Perform waste package Advanced Conceptual Design. Submit the waste package Advanced Conceptual Design to DOE-HQ for review and approval and to each site for review and comment. Conduct design review meetings, provide proposed resolution of comments to DOE-HQ, and incorporate comments per DOE-HQ direction.

- Perform waste package License Application Design and analyses for DOE's submittal of the License Application. Assist DOE-HQ in resolving comments on the waste package portion of the License Application.

- Consistent with the License Application, provide the design, including drawings and specifications, for the fabrication of the waste package.

- Identify requirements for tests and develop plans to qualify the waste package design. Ensure implementation of the test plans and evaluate the resulting data from tests for adequacy to meet licensing requirements.

- Provide economic analyses for waste package designs, and analyze the impact of these designs on the total cost of the Civilian [illegible] Management System.

- Consistent with technical requirements for interface control, [illegible] that waste package interfaces have been identified and controlled.

5) Waste Package Performance Assessment

- Develop (as needed), verify, validate, benchmark, and document computer codes for assessing the performance of the waste package. Identify and prioritize data required for performance assessment.

- Perform analyses that demonstrate with reasonable assurance that the waste package and engineered barrier designs will meet the regulatory requirements. Ensure that data and analytical models have been qualified, documented, and controlled.

- Provide for peer review of analyses. Submit analyses to DOE for review and incorporation into the License Application Design.

- Identify and analyze uncertainties in waste package elements as they relate to site characterization data.

1.X.0300 Site

The Contractor is responsible for evaluating existing site investigation programs described in the SCPs for the three candidate sites and for providing technical direction for future site characterization activities. Based on the issues hierarchy and issue resolution strategy, the review of the SCP shall concentrate on the assessment of whether planned investigations will be successful in resolving design and performance issues for the three sites. Special attention shall be given to designing site programs that are adequate for licensing the three sites and to ensuring that such site programs are comparable. The work in the site program shall support preparation of SCP progress reports, study plans, the environmental impact statement, licensing topical reports, the site selection report and associated analyses, and the License Application. The activities to be performed by the Contractor include, but are not limited to, the following:

1) Management and Integration

- Provide management of activities including planning, scheduling, budgeting, controlling, and reporting.

- Provide for interaction and coordination with other OCRWM program participants related to site activities.

- Provide technical expertise in the geosciences (e.g., geology, hydrology, seismology, geophysics, geochemistry, tectonics, climatology, and natural resource evaluation) necessary to plan and define the technical effort of participants in resolving design and performance issues in sufficient detail to meet the regulatory [illegible]

- Provide study plans for the technical direction of participants to implement necessary site characterization activities in the various geoscience disciplines listed above.

2) Geologic

This consists of work in fields of stratigraphy, structural geology, seismology, tectonics, geophysics, paleoclimatology, geomorphology, and natural resource evaluation. Both local geology and the regional context shall be considered. More specifically the Contractor shall:

- Define requirements and strategies for obtaining geologic field and laboratory data to address issues identified in the SCPs. These would be documented in the SCP progress reports and/or study plans related to geologic studies. Requirements on field-testing shall be provided to project contractors.

- Evaluate geologic data-acquisition methods and procedures to ensure adequacy in meeting program requirements. This includes supporting DOE in the conduct of on-site audits and surveillances of field activities implemented by project participants.

- Evaluate and interpret data obtained by project participants and prepare required documents.

- Integrate stratigraphic and structural data to provide geologic and tectonic models to support hydrologic activities, to support performance assessment activities, and provide host-rock geometry information to design. Work shall include characterization and documentation of potentially disruptive geologic scenarios in response to preclosure and postclosure performance assessment needs.

3) Hydrologic

This consists of activities such as the analysis of data from pumping tests in boreholes, well logging, tracer tests; development of conceptual and numerical models of the hydrologic flow system for the site and region; surface water investigations; and calculations of flood potential. Both the unsaturated and saturated zones are to be considered as well as porous and fractured media. More specifically, the Contractor shall:

- Define requirements and strategies for obtaining hydrologic field and laboratory data to address issues identified in the SCP. These would be documented in the SCP progress reports and/or study plans related to hydrologic studies. Requirements on field-testing shall be provided to project contractors.

- Evaluate hydrologic data-acquisition methods and procedures to ensure adequacy in meeting program requirements. This includes supporting DOE in the conduct of on-site audits and surveillances of field activities implemented by project participants.

- Evaluate and interpret data obtained by project participants and prepare required documents.

- Integrate hydrologic data to provide conceptual and numerical models of site vicinity and region to support performance assessment and design activities. Develop probabilistic estimates of ground-water travel times from repository to the accessible environment.

4) Geochemical

This consists of the chemical aspects of both the host rock and surrounding environment and the fluids within them. It includes studies of the mineralogy and petrology of site, ground-water dating, hydrogeochemistry, geochemical retardation, radionuclide solubilities, and natural analogs. More specifically, the Contractor shall:

- Define requirements and strategies for obtaining geochemical field and laboratory data to address issues identified in the SCPs. These would be documented in the SCP progress reports and/or study plans related to studies. Requirements on field-testing shall be provided to project contractors.

- Evaluate geochemical data-acquisition methods and procedures to ensure adequacy in meeting program requirements. This includes supporting DOE in the conduct of on-site audits and surveillances of field activities implemented by project participants.

- Evaluate and interpret data obtained by project participants and prepare required documents.

- Define requirements and strategies for assessing the effect of the in-situ environment on the waste package, the ability of the host rock to contain radionuclides, and the ability of the host rock and surrounding units to retard radionuclides by chemical interactions.

- By integration of geochemical data, develop geochemical speciation and reaction path models and develop conceptual hydrochemical models to support or refute alternative ground-water flow system models.

5) Drilling

SEDM Contractor not responsible for this WBS element, including core sample management.

6) Environmental

- For the site selection and licensing processes, provide technical direction to each site in terms of identifying environmental data needs such as weather conditions and air quality, plant and animal communities and habitats, agricultural sources, cultural and archaeological resources, noise, and background radiation. Evaluate adequacy of each project's test plans and technical control systems in providing data for licensing analyses. Evaluations of test plans shall take into account that existing facilities engaged in current testing are to be given consideration for any testing activities.

- Utilizing test data, perform analyses with models or provide technical direction to others to perform analyses with models to provide data for site performance assessment.

- Assist DOE in assessing and identifying strategies for mitigation of the environmental impacts that a repository might have at each of the candidate sites.

7) Socioeconomic

- For the site selection and licensing processes, identify additional socioeconomic data requirements such as demographic characteristics, labor-force characteristics, housing, community services, and land use. Evaluate the data and conduct appropriate analyses of the sites.

- Assist DOE in assessing and identifying strategies for mitigation of the socioeconomic impacts that a repository might have at each of the candidate sites.

8) Performance Assessment

- Develop (as needed), verify, validate, benchmark, and document computer codes for assessing the performance of the waste package. Identify and prioritize data required for performance assessment.

- Provide for peer review of analyses. Submit analyses to DOE for review and incorporation into the License Application.

1.X.0400 Repository

The Contractor shall be responsible for repository design; identification of testing and development requirements; and technical direction, conduct, and analysis of the required testing and development activities. The activities to be performed by the Contractor include, but are not limited to, the following:

1) Management and Integration

- Provide management of repository activities including planning, scheduling, budgeting, controlling, and reporting.

- Using input from each of the three candidate repository sites, provide overall repository planning and prepare a schedule for repository activities for each site.

- Provide for interaction and coordination with other OCRWM program participants on repository activities.

- Perform repository Advanced Conceptual Design. Submit the repository Advanced Conceptual Design to DOE-HQ for review and approval and to each site for review and comment. Conduct design review meetings, provide proposed resolution of comments to DOE-HQ, and incorporate comments per DOE-HQ direction.

- Perform repository License Application Design and analyses for DOE's submittal of the License Application to NRC. Assist DOE-HQ in resolving comments on the repository portion of the License Application.

- Consistent with the License Application, provide the design, including drawings and specifications, for the repository.

- Provide Title III design inspection services.

- Provide economic analyses for repository designs, and the impact of these designs on the total cost of the Nuclear Waste Management System.

- Ensure integration of the exploratory shaft facility into the repository facility design, construction, operation, and closure plans.

4) Operations/Maintenance

- Provide input to the design and safety analyses of the repository through definition of (1) modes of operation of all systems and equipment; (2) procedures for assembly, emplacement, monitoring, and retrieval of waste package; and (3) maintenance requirements of the operational facility.

- Develop repository facility operating concepts and modes and conduct necessary trade-off and optimization studies in areas such as waste receipt; lag storage; packaging and handling; seal and backfill emplacement; hauling, storage, and disposal of mined material; waste package fabrication, preparation, repair, handling emplacement, and retrieval; safeguards and security; acceptance testing and readiness reviews; maintenance and logistics support; and personnel staffing.

5) Decommissioning

- Establish decommissioning concepts, requirements and design necessary to support the License Application Design.

6) Repository Performance Assessment

- Develop (as needed), verify, validate, benchmark, and document computer codes for assessing the performance of the repository. Identify and prioritize data required for performance assessment.

- Perform analyses that demonstrate with reasonable assurance that the repository engineered barrier system designs will meet the regulatory requirements. Assure that data and analytical models have been

- Provide technical expertise in geologic engineering necessary to plan and define the technical effort of participants in establishing the scientific and engineering basis to demonstrate that the repository configuration, including rock stability and seal performance, meets the regulatory requirements.

- Provide study plans for the technical direction of participants to implement necessary site characterization activities in the various repository disciplines.

2) Development and Testing

- Specify and provide technical direction for all repository testing and development activities including study of engineering properties of rock characteristics. Provide rock mechanics data requirements to the project contractors. Evaluate and apply rock mechanics data in developing the repository design basis and in developing the design.

- Evaluate equipment needs and develop equipment as required, including the design, fabrication, and testing of prototypes. This includes excavation/transport equipment, waste handling equipment, and backfill equipment. Evaluate monitoring and instrumentation needs. Adapt existing and develop new instruments as required.

- Establish sealing requirements, including requirements due to both anticipated and unanticipated conditions, and develop sealing concepts for the repository. Evaluate preclosure and postclosure concepts and designs for sealing shafts, underground excavations, and boreholes. Evaluate potential materials for sealing shafts, underground excavations, and boreholes. Test the performance of selected sealing materials and design. Provide input to repository design and performance assessment tasks.

- Prepare the Advance Conceptual Design and License Application Design for seals consistent with workscope for the repository facilities design.

3) Facilities

- For each site, review the repository SCP conceptual design, all repository design studies performed subsequent to completion of the SCP conceptual design, and repository system requirements documents. Based on reviews, identify additional studies that should be performed prior to or during Advanced Conceputal Design and recommend changes, if necessary to the site-specific system requirements or subsystem design requirements documents.

- Maintain the repository subsystem design requirements documents consistent with the site-specific system requirements documents and the MGDS Generic Requirements Document. Evaluate proposals to change the repository subsystem design requirements documents and submit recommendations to the DOE Change Control Board.

qualified, documented, and controlled.

- Provide for peer review of analyses. Submit analyses to DOE for review and incorporation into the License Application Design.

- Identify and analyze uncertainties in repository elements as they relate to site characterization data.

- Confirm and maintain the performance objectives of the repository and establish the list of systems, structures, and components important to safety and engineered-barriers important to waste isolation.

1.X.0500 Regulatory and Institutional

The Contractor shall be responsible for the management and conduct of the licensing process, and shall assist DOE in meeting environmental compliance responsibilities, and in conducting institutional activities. The activities to be performed by the Contractor include, but are not limited to, the following:

1) Management and Integration

- Provide management of activities including planning, scheduling, budgeting, controlling, and reporting.

- Provide for interaction and coordination with other OCRWM program participants related to regulatory and institutional activities.

- Provide technical and regulatory expertise in the full range of disciplines necessary to provide guidance and review of all regulatory and institutional documents, both internal and external. Assist DOE by obtaining consultants and outside technical and regulatory expertise for review of specialized documents and licensing strategies.

2) Licensing

The Contractor shall perform activities necessary to ensure compliance with regulatory requirements and support the license application for the first repository, including preparation of analyses and documents. The activities to be performed by the Contractor include, but are not limited to, the following:

- Submit SCP progress reports to DOE-HQ, the three projects, and other program participants for review. Document comments received and prepare proposed resolutions for DOE approval. Incorporate comments per DOE direction. Provide updated technical direction to each site consistent with the SCP progress reports.

- Assist DOE in the identification of regulatory requirements. This effort will include review and analysis of all regulatory requirements pertinent to repository activities. The Contractor will review implementation of existing regulatory requirements including definitions employed in planning and design documents, and recommend to DOE changes necessary to ensure compliance with regulatory requirements and to enhance the likelihood of obtaining a timely authorization to construct the repository. For purposes of this effort, regulatory requirements will include but not be limited to regulations such as 10 CFR 2, 20, 51, 60, 71, 72 and 170; NRC staff guidance such as Regulatory Guides, Standard Review Plans, Generic Technical Positions and letters received from various NRC staff functions; NRC positions taken in reports; Statements of Consideration; Advisory Committee on Reactor Safeguards Letters; and pertinent case law.

- Operate and maintain the Program's Licensing Support System. (Reference 9).

- Provide licensing review of analyses, studies, plans, specifications, and drawings to ensure compliance with regulatory requirements and DOE commitments. The Contractor will also review all responses to the NRC or to other parties to ensure consistency with regulatory requirements, DOE commitments and DOE licensing policy.

- Provide support to DOE for all meetings with the NRC and for all other licensing issues meetings. This effort will include: a) pre-meeting review of all materials to be presented, used as source material, or to be used as backup material to ensure the material is appropriate, consistent with regulatory requirements, DOE commitments, and DOE licensing policy; b) review of dry run presentations; c) preparation of graphics and written material for approval by DOE for presentation and to be published as meeting summaries; d) preparation of complete meeting reference packages for all parties prior to the meeting; and e) distribution of the meeting reference packages to all parties in keeping with DOE commitments for timely notice.

- Prepare for DOE-HQ approval a complete License Application as required under 10 CFR 60 for a geologic repository at each of the candidate sites. The Contractor will review the repository License Application annotated outline and recommend for DOE approval changes and enhancements necessary to ensure compliance with regulatory requirements and completeness. This effort will include all support necessary for submittal of the License Application for the designated site for construction of the repository, the successful conduct of the licensing process, and the receipt of the construction authorization.

- Establish and operate a comprehensive commitment tracking system in conjunction with its responsibilities to operate the Licensing Support System. This commitment tracking system will provide the means to ensure that all DOE commitments to the NRC, States, Indian Tribes, other Federal agencies and other designated parties are tracked from inception to successful closure. This system will maintain the historical record of the origin of the commitment, the actions taken by all parties and the agreements that represent the successful closure of each commitment.

- Establish and maintain a comprehensive document review and control system. The purpose of this system will be to ensure that all incoming reports, correspondence, etc. are reviewed by the cognizant organizations and that information that could impact on the program is identified and integrated into the program licensing and other decisions.

- Develop and maintain the OCRWM Licensing Procedures Manual (LPM). The LPM will provide comprehensive procedures for the DOE and contractor interaction with the parties involved in the licensing process and the conduct of the licensing program.

- Recommend for DOE-HQ approval, and implement upon that approval, regulatory actions that will assist in ensuring early closure of licensing issues and improve the likelihood of timely authorizations from the NRC. These regulatory actions will include Topical Reports, Regulatory and Technical Issues Papers addressing either site-specific or generic issues, proposed rule making, and proposed changes to NRC or other agency staff positions.

3) Environmental Compliance

The Contractor shall perform activities to assist DOE in ensuring compliance with applicable Federal, state, and local statutory and regulatory requirements related to siting and the environment. The activities to be performed by the Contractor include, but are not limited to, the following:

- Assist DOE in identifying applicable Federal, State and local regulatory environmental requirements. This effort will include review and analysis of all environmental requirements pertinent to repository activities. The Contractor will define the necessary requirements for site-specific environmental and siting studies. The Contractor will review existing compliance efforts and recommend to DOE changes necessary to ensure compliance with environmental regulatory requirements and enhance the likelihood of obtaining necessary permits and approvals in a timely fashion.

- Provide analytical review of environmental data and studies to ensure compliance with environmental regulatory requirements, DOE commitments and DOE environmental policy. Based on these reviews, provide advice and recommendations to DOE as it prepares responses to Congress, the States and Indian Tribes, and other interested parties. The advice and recommendations are intended to ensure adequacy and consistency with environmental regulatory requirements.

- Prepare for DOE-HQ approval environmental siting documents required to comply with the NWPA and prepare environmental reports. These environmental reports will contain the information necessary for development and preparation of the environmental impact statement (EIS). The Contractor will:

a) Assist DOE-HQ in the EIS scoping process. This effort will include: (1) preparation and distribution of the Notice of Intent and any accompanying documents to the public of DOE's intent to prepare an EIS; (2) logistics support in securing locations for the conduct of the scoping meetings and public hearings; (3) preparation of descriptive material to be disseminated at the meetings and hearings as general information on the content of the EIS; (4) review of meeting and hearing transcripts to ascertain new DOE commitments and additional data relevant to the preparation of the EIS; and (5) preparation of responses to comments and questions received at the scoping meetings and hearings.

b) Assist DOE in the preparation of the draft EIS Implementation Plan to incorporate the results of the public scoping process and guide the preparation for the EIS. This effort will include careful review and analysis of existing program documents as well as the EIS requirements set forth under the National Environmental Policy Act and Council on Environmental Quality regulations.

c) Assist DOE in the development of a detailed EIS Management Plan to ensure timely EIS preparation. This effort will include selection of target time limits for EIS preparation, the relationship between the timing of environmental analyses preparation and decision-making schedule, and the identification of organizational reporting relationships within OCRWM and the coordination concurrence processes needed to produce the EIS.

d) Assist DOE in EIS data collection. This effort will include: (1) analysis of environmental data to assess the impacts associated with siting, constructing, operating, closing and decommissioning of a high level waste repository; (2) coordinate the monitoring of field activities for EIS data collection; (3) coordinate the development of models and other analytical tools for the preparation of the EIS; and (4) preparation of topical reports to be used as a reference in the preparation of the EIS.

- Assist DOE in the development of agreements with appropriate Federal, State and local agencies. This effort will include review of NWPA to determine the roles of each agency in implementing NWPA, review of existing agreements and recommendation to DOE-HQ of the best agreement approach to ensure consistency with the roles defined for each agency under NWPA.

- Establish and maintain for DOE-HQ a comprehensive document review and control system. The purpose of this system will be to ensure that all incoming reports, correspondence and other documents are reviewed by the cognizant organizations and that information that could impact on the program is identified and integrated.

- Assist DOE in the site selection methodology analysis to be performed in accordance with the DOE siting guidelines (10 CFR 960).

4) Communication and Liaison

- Perform activities necessary to assist DOE in ensuring that the consultation and cooperation requirements of the NWPA are met. Upon award, the Contractor will become thoroughly familiar with the history of past interactions with the affected States and Indian Tribes.

- Assist in developing outreach and public information materials related to the repository program. Provide analytical support in review of Facility Specific Outreach and Participation Plans. (Reference 10)

- Assist DOE in the organization development, and conduct of public interaction meetings, meetings between DOE and States and Indian Tribes, public briefings and hearings related to issuance of major program documents, and other meetings as identified by DOE.

- Assist DOE in the preparation and dissemination of information regarding the Contractor's activities.

5) Financial and Technical Assistance

- Assist DOE in conducting technical reviews of work proposed by affected States and Indian Tribes under grant requests to ensure that the work is integrated with site characterization activities conducted by DOE.

1.X.0600 Exploratory Shaft

The Contractor shall provide technical direction for exploratory shaft testing and provide design requirements for any necessary facility modifications. The activities to be performed by the Contractor include, but are not limited to, the following:

1) Review the existing in-situ test programs and define requirements for changes or for further testing; conduct analyses of test data.

2) Establish detailed design requirements for facility modifications and decommissioning.

1.X.0700 Test Facilities

The Contractor shall assess the need and develop requirements for additional field test facilities and related support facilities. Existing facilities engaged in current testing shall be given consideration.

1.X.0800 Land Acquisition

The Contractor shall be responsible for the evaluation of land requirements for the repository and the supporting facilities, and shall support the land acquisition process. The activities to be performed by the Contractor include, but are not limited to, the following:

1) Analyze, evaluate, and recommend the boundaries of the controlled

area within the context of the accessible environments and other site-specific variables.

2) Analyze, evaluate, and recommend the land requirements for repository support facilities (e.g. roads, railroads.)

3) Support the preparation of analyses and documents required for land acquisition, for land use consistent with established constraints, or for ultimate disposition.

1.X.0900 Project Management

Contract workscope for this WBS element is included in Section IV.

b. Second Repository

The Contractor is assigned responsibilities for the second repository in areas such as integrating second repository requirements with the Nuclear Waste Management System and assisting second repository program participants to: 1) ensure compliance with the NWPA; and 2) ensure that techniques, strategies, design concepts, and plans developed for the first repository are utilized where appropriate and that lessons learned on the first respository are incorporated into second repository planning and implementation. In doing so, the Contractor shall, as directed by DOE-HQ, develop conceptual descriptions and data requirements/analyses of second repository facilities and engineered components to support any planned siting studies and perform preliminary studies and analyses. The Contractor shall also ensure transfer of the repository technology development program information, in particular the international cooperative efforts, to the Program participants.

2. FEDERAL INTERIM STORAGE

SEDM Contractor not responsible for this WBS element.

3. MONITORED RETRIEVABLE STORAGE

Should DOE receive Congressional approval for the construction of a Monitored Retrievable Storage (MRS) facility as part of the Nuclear Waste Management System, the Contractor will be required to provide design and licensing services for the MRS. The Contractor will provide the design and licensing services unless and until DOE makes a decision to transfer detailed design, construction, and operations of the MRS to a separate requirement to be competed. The Contractor would be required to assist in the transition of that workscope to the other contractor. The Contractor will continue to retain the overall Nuclear Waste Management System integration function.

The following scope of work will apply only if the Congress approves construction of an MRS. The workscope is listed under an MRS WBS that is a proposed revision to the OCRWM WBS.

3.0.0100 Environmental Evaluations

Manage the preparation of environmental documentation. Recommend to DOE mechanisms and strategies for mitigation of environmental and socioeconomic impacts.

3.0.0200 Design

1) Identify facilities, systems, and equipment important to safety. Prepare requirements for development and implementation of a design verification program, including the conduct of design feature tests and prototype equipment tests. Specify the site data requirements for the design and environmental documentation.

2) Establish a rigorous design and interface management system in compliance with NRC and DOE requirements, and develop detailed MRS design, functional, performance, and interface requirements controlled by this system.

3) Develop the design sufficient to support the license application in compliance with the facility and system requirements, the NRC requirements of 10 CFR 72, and appropriate regulatory guides, applicable DOE Orders, and other applicable NRC requirements.

3.0.0300 Regulatory Compliance

1) Assist DOE in interactions with the NRC, EPA, and other Federal and/or State agencies.

2) Assist DOE in all aspects of the MRS licensing process, including regulatory considerations and resolution of technical issues prior to License Application.

3) Review, analyze, and provide assistance in identification of regulatory requirements. This includes defining licensing strategies, preparing pre-licensing and licensing documents, such as the Safety Analysis Report, License Application, and assisting in the licensing process.

4) Evaluate and establish the adequacy of data, reports, and analyses prepared for inclusion in pre-licensing and licensing documents or used to support these documents.

5) Assist DOE and the MRS implementation contractor(s) as necessary to ensure compliance with facility licensing requirements and in the development of proper operating and maintenance procedures leading to compliance with license requirements.

3.0.0400 Construction

SEDM Contractor not responsible for this WBS element.

3.0.0500 Quality Assurance

SEDM Contract workscope for this WBS element is included in Section IV.

3.0.0600 Operations

SEDM Contractor not responsible for this WBS element.

3.0.0700 Institutional Interactions

1) Assist in developing guidelines, tracking systems and providing other analytical support for the consultation and cooperation process.

2) Assist in developing outreach and public information materials.

3) Provide analytical support for assessing socioeconomic impact of MRS development including identification of the mechanisms and strategies for mitigating such impacts.

4) Provide assistance to DOE in organization, development, and conduct of public interaction meetings, meetings between DOE and State(s), public briefings and hearings related to issuance of major program documents, and other meetings as identified by DOE.

5) Assist DOE in assessing the mechanisms and strategies for mitigation of environmental and socioeconomic impacts of the MRS.

6) Assist DOE in the preparation and dissemination of information regarding the Contractor's activities.

3.0.0800 Project Management

SEDM Contract workscope for this WBS element is included in Section IV.

4. TRANSPORTATION

The transportation system is comprised of: (1) the cask system, which includes the package, the vehicular conveyance, tie-downs, ancillary equipment, and associated handling equipment designed for use within the transportation system; (2) the transportation support system, which includes the control center, maintenance and inspection facilities, and other facilities required to support waste transport; and (3) operational plans, which will be employed as implementing procedures to operate the cask system and the support system. The operational plans shall consider the technical, management, and institutional aspects of the transportation system. The activities to be performed by the Contractor include, but are not limited to, the following (listed under a proposed revision to the OCRWM WBS):

4.0.0100 Cask Systems Development

SEDM Contractor not responsible for this WBS element.

4.0.0200 Support Systems Development

SEDM Contractor not responsible for this WBS element.

4.0.0300 Operations

SEDM Contractor not responsible for this WBS element.

4.0.0400 Institutional Planning and Analysis

SEDM Contractor not responsible for this WBS element.

4.0.0500 Systems Analysis

Perform needed transportation system studies in support of the technical baseline and the operational plans.

4.0.0600 Management and Integration

1) Develop and maintain a technical baseline containing the transportation cask and support system requirements and descriptions and the definition of transportation system interfaces.

2) Determine the spent fuel and high-level waste cask and support system requirements (e.g. functional requirements and interface definitions).

3) Monitor and integrate transportation sub-program elements to ensure adherence to the technical baseline throughout the development of the transportation system (cask system, the support system, and the operational plans).

4) Incorporate the results of institutional issue resolution studies into the technical baseline for the transportation system.

5) Provide technical liaison with transportation subprogram participants whose activities include: cask system design, development, and fabrication; operational planning; and support system design and construction.

6) Establish management control and quality assurance activities for the transportation element of the Nuclear Waste Management System (analagous to those provided for the repository and MRS elements).

5. RESEARCH AND DEVELOPMENT

This research and development work is funded under the Civilian Research and Development Program appropriation, and is not a part of the work to be assigned to the Contractor.

5.0.0100 Subseabed

SEDM Contractor not responsible for this WBS element.

5.0.0200 Dry Storage

SEDM Contractor not responsible for this WBS element.

5.0.0300 Rod Consolidation

SEDM Contractor not responsible for this WBS element.

6. PROGRAM MANAGEMENT

6.0.0100 Program Direction

According to the OCRWM WBS, the Program Direction element, WBS 6.0.01, provides for Federal personnel to implement the NWPA. Accordingly, this WBS element is not applicable to any contractor activities.

6.0.0200 Systems Integration

The Contractor shall develop and control the configuration for the Nuclear Waste Management System to include specification and control of the functional and performance requirements for the individual system elements and the interfaces between those elements. Activities to be performed by the Contractor include, but are not limited to, the following:

1) Evaluate, modify (as needed) and control the Nuclear Waste Management System requirements baseline. This includes schedule, functional requirements, performance criteria, and interface controls. Evaluate, modify (as needed), and control the system description and maintain current descriptions of each system element (repositories, MRS (if authorized), and transportation).

2) Select or, if necessary, develop an overall systems model capable of identifying and evaluating system design, cost, and schedule impacts of alternative system configurations.

3) Conduct analyses of alternative system configurations, including interfaces between the system elements.

4) Perform system studies as required to ensure total system integration and optimization. Where appropriate, recommend changes to the systems baselines.

5) Serve as Secretary to OCRWM Program Change Control Board (CCB) and maintain its records. Provide current system baseline information to Program participants.

6) Monitor all system interfaces involving more than one Nuclear Waste Management System element to ensure that all physical and schedule interfaces are adequately characterized and baselined, that changes to the interfaces are adequately controlled, and that lead responsibility for design of the interfaces is assigned. Perform analyses to ensure that all such interfaces have been identified and adequately characterized. Maintain current interface descriptions.

7) Perform risk assessments and, where necessary, develop models and codes, including required verification, validation and documentation to meet regulatory and licensing requirements for the Nuclear Waste Management System.

8) Develop estimates of the costs of each system element of the Nuclear Waste Management System. This includes costs for facilities and services provided under the Nuclear Waste Fund (e.g., repository, transportation, waste acceptance, etc.). Such estimates will be used as input data to DOE-HQ for the Total System Life Cycle Cost analyses which are to be performed annually. Where necessary, develop additional capabilities to perform such estimates. In addition, estimates of costs borne by the waste generators that are directly related to waste-funded activities (e.g., costs to prepare, store, or package wastes at the waste generator sites) may also need to be developed.

9) Manage, direct or monitor programs to evaluate and, if justified, develop various processes or technologies that will be used by or will strongly affect more than one system element. Such processes or technologies include dry rod consolidation techniques/equipment, robotics, packaging techniques (fabrication, sealing, decontaminating, testing, etc.), and secondary waste treatment processes, including volume reduction of non-fuel bearing components.

6.0.0300 Policy

SEDM Contractor not responsible for this WBS element.

6.0.0400 Outreach

SEDM Contractor not responsible for this WBS element, other than those covered in Section III.C.1 and III.C.3.

6.0.0500 Administration

SEDM Contractor not responsible for this WBS element.

6.0.0600 Fund Management

SEDM Contractor not responsible for this WBS element.

6.0.0700 Quality Assurance

Contract workscope for this WBS element is included in Section IV.

6.0.0800 Technical Support

SEDM Contractor not responsible for this WBS element.

IV. MANAGEMENT CONTROL SYSTEM

This Section describes functions and requirements of management control systems for the Contractor. These systems will specify how the contract workscope is to be performed.

A. OVERVIEW OF MANAGEMENT CONTROL SYSTEM REQUIREMENTS

The Contractors' management control system must meet OCRWM requirements as well as relevant DOE Orders, particularly 4700.1 and 2250.1B. Upon award, the Contractor shall begin preparation of a Project Management Plan (PMP), a Systems Engineering Management Plan (SEMP), and a Quality Assurance Plan (QAP or QA Plan) all of which will be approved by DOE-HQ. These three key documents will represent the basic agreement between DOE and the Contractor as to which OCRWM and DOE requirements apply to SEDM contract work and when they are applicable.

These three key documents will identify required plans and procedures to be prepared by the Contractor and program participants interacting with the Contractor. A list of these plans and procedures as well as who prepares, concurs on, and approves them will be identified in the three key documents.

Requirements indicating when the management control system must be demonstrated and approved are included in Section V.

B. PROJECT MANAGEMENT CONTROL SYSTEM

1. Project Management Functions

The Contractor shall provide technical, financial, schedular, and contractual plans/strategies required to manage its work described in this Statement of Work. The functions to be performed by the Contractor include, but are not limited to, the following:

a) Establish, maintain, and operate a project management system to ensure that all work under the contract is adequately defined, scheduled, budgeted, and performed in a manner that meets the schedule, cost, and technical requirements, and that the reporting requirements of the contract are satisfied.

b) Establish and implement procedures for a document control system to control changes to baselined program management/technical documents.

c) Maintain and operate parts of the integrated Information Management System (IMS) related to SEDM Contract work. Provide required hardware and software to operate this part of the IMS. Responsibilities include storage and retrieval of existing and new information relevant to the Contractor's work. The IMS must be operated in a manner that satisfies the data storage and retrieval requirements of the Licensing Support System.

d) Perform internal contract management and control activities necessary to direct technical and administrative efforts including short and long-range planning, facilities management, financial analysis, contract reporting, staff training, procurement, and subcontract management.

2. Project Management System Requirements

Basic requirements and guidance for development and implementation of project management control systems for OCRWM Program participants are described in two documents, DOE Order 4700.1 (Reference 4) and the OCRWM Program Management System Manual.

DOE Order 4700.1, Project Management System, establishes the DOE project management system and provides implementing instructions for development, approval, and execution of DOE's outlay program acquisitions. Requirements in 4700.1 and its references to Major Systems Acquisitions are applicable to the Contractor's work on the first repository and the MRS. The first repository and the MRS have been designated as Major Systems Acquisitions. As required by DOE Order 4700.1, the Contractor will be required to establish a performance measurement system that can be validated to meet the Cost/Schedule Control System Criteria (C/SCSC) in DOE Order 2250.1B.

The OCRWM Program Management System Manual provides supplementary requirements and guidance for OCRWM Program participants including the Contractor. The Program Management System Manual describes subordinate OCRWM documents that provide additional project management control system detail and are also applicable to this contract. As noted previously, it is anticipated that the OCRWM documents will be revised as needed to reflect the new program organization as the Contractor begins work.

3. Project Management Plan

The Contractor is required to prepare a Project Management Plan (PMP) for Contractor activities. The PMP will be approved by DOE-HQ. Input to the PMP on DOE organizational responsibilities will be provided by DOE-HQ, including responsibilities of the DOE Project Offices, Operations Offices and their contractors. The Contractor is responsible for preparing, distributing, controlling, and updating the document. Revisions to the PMP will also be approved by DOE-HQ.

Guidance on preparation and organization of the PMP is provided in Attachment II-4 of DOE Order 4700.1. Unless specifically agreed to by DOE-HQ, the PMP will contain all information as recommended by DOE 4700.1. In addition, it will address the regulatory and institutional requirements in the OCRWM Program Management System Manual. Technical control systems will be addressed in the SEDM SEMP and the PMP needs only to reference the

SEMP. Likewise, Quality Assurance (QA) systems will be addressed in the SEDM QA Plan and the PMP needs only to reference the QA Plan.

The SEDM PMP will establish requirements for preparation of SEDM project management, regulatory, and institutional plans and procedures as specified by DOE 4700.1 and its references, and the OCRWM Program Management System Manual. Other project management, regulatory, and institutional plans that the contractor considers necessary to control contract work should also be addressed in the PMP. The SEDM PMP shall include a matrix that, as a minimum, lists the SEDM program management, regulatory, and institutional plans and procedures, who approves them, and whether they are or are not required for authorization to begin technical work.

C. TECHNICAL CONTROL SYSTEM

1. Systems Engineering Management Plan

The OCRWM SEMP (Reference 11) specifies technical control requirements for the entire OCRWM program. Consistent with the OCRWM SEMP, the OGR SEMP (Reference 12) specifies technical control requirements for work performed under WBS 1.0.0000, Mined Geologic Disposal System. If the MRS is approved by Congress, it is anticipated that a SEMP for the MRS will be prepared.

The Contractor is required to prepare a SEMP that implements the requirements of the OCRWM SEMP for all workscope and specifically implements the requirements of the OGR SEMP for workscope under WBS element 1.0.0000 and MRS SEMP for workscope under WBS element 3.0.0000 (if and when the MRS SEMP is prepared). The SEDM SEMP will define requirements for control of technical work that is the responsibility of the Contractor, whether the work is actually performed by the Contractor or another contractor performing work under Contractor technical direction.

The SEDM SEMP shall interface with the PMP and the QA Plan.

Key items to be addressed in the SEMP are as follows:

a) Identification of implementing technical procedures and plans required for performance of work, organizations responsible for preparing the plans and procedures, the organizations responsible for concurrence and approval, and whether or not the procedure is required for authorization to begin technical work.

b) Systems engineering approach to be used.

c) Configuration control, including control of technical documents such as systems and subsystems requirements documents, drawings, and specifications.

d) Design reviews and other technical reviews including peer reviews; and, the requirements for documentation of design reviews.

e) Test management.

f) Software control/verification.

g) Technical interface control.

h) Methodology for performance assessment.

i) Documentation of technical decisions including which and when decisions must be documented and how they are to be documented.

In coverage of the above items, the SEMP shall specify requirements for performance of technical work including preparation of implementing work plans and procedures. Implementing work plans will focus on what technical work is to be performed, the resources required, and the schedule. Implementing procedures will focus on how technical work is to be performed and will include step-by-step actions where necessary to ensure control of work.

The Contractor is responsible for preparing, distributing, controlling, and updating the SEDM SEMP. The SEMP will be submitted for DOE-HQ approval. Following approval, the SEMP will be issued as a controlled document. It must be kept up to date at all times. Revisions to the SEMP will also be approved by DOE-HQ.

2. Work Plans

The purpose of work plans is to ensure integration of technical work which is performed under more than one major WBS element. Work plans shall be prepared for major contract activities such as:

a) Advanced Conceptual Design (ACD),
b) License Application Design (LAD),
c) Final Procurement and Construction (FPC) Design, and
d) License Application Safety Analysis.

As a minimum, work plans will address the scope of work and deliverables to be prepared, the schedule and resources to accomplish the work, and the reference documents that establish requirements for performing work.

Work plans will be approved by DOE-HQ prior to initiation of work for the phase covered by the work plan. If significant replanning becomes necessary, DOE-HQ may require revision of a work plan.

D. QUALITY ASSURANCE

1. Quality Assurance Functions

Quality assurance functions to be performed by the Contractor include, but are not limited to, the following:

a) Develop and implement an internal Quality Assurance Program. The internal QA program will be described in a formal QA Plan that will be reviewed and approved by DOE-HQ and the NRC. The Contractor will be responsible for all actions necessary to ensure the continued acceptance of the QA Plan by the NRC and will recommend for DOE approval any changes necessary to assure continued NRC approval.

b) Develop all necessary implementing procedures to put in to effect the Contractor's approved internal QA Plan and ensure that all personnel are trained as necessary in those procedures.

c) Perform audits, surveillances, management assessments and inspections to verify the continued adequate implementation of the SEDM Contractor's internal QA Plan. These activities will include both verification of compliance with QA requirements and adequacy of the technical and programmatic results being achieved by the various operating elements of the Contractor's forces.

d) Support DOE in the full range of QA activities necessary for DOE to carry out its QA responsibilities with regard to OCRWM and its respective Project Offices. These activities will include participation in audits, surveillances and inspections for both compliance and adequacy, preparation of reports on the above activities, performance of trend analyses, review of root cause analyses, and review of corrective action reports for adequacy.

e) Develop and conduct QA indoctrination and training for the Contractor's activities and in support of DOE for other program participants.

f) Review technical reports, design documents and procurement documents to ensure compliance with QA requirements for the Contractor's activities and in support of DOE for other program participants.

g) Analyze QA audits to identify deficiencies and recommend corrective action for the Contractor's activities and in support of DOE for other program participants.

h) Review QA plans and procedures for DOE projects and other contractors and recommend action.

i) Assist DOE in continuing development of DOE QA plans and procedures. The Contractor will review all existing QA documents and propose for DOE approval modifications necessary to ensure compatiability with the Contractor's QA program and the QA programs of other program participants.

2) Quality Assurance Requirements

The Contractor Quality Assurance system shall meet the applicable requirements of DOE Order 5700.6B, Quality Assurance (Reference 13), the

OCRWM Quality Assurance Management Policies and Requirements (Reference 14), the OGR Quality Assurance Plan For High-Level Radioactive Waste Repositories (Reference 15), 10 CFR 60 (Reference 16), 10 CFR 50 Appendix B (Reference 17), 10 CFR 71 (Reference 18), 10 CFR 72 (Reference 19), ANSI/ASME NQA-1 (Reference 20) and any other applicable QA requirements and/or program QA documents (such as subsequent issuance of OCRWM MRS or Transportation QA Plans) that are necessary to obtain required licenses and to ensure quality activities, data & products. In addition to the above requirements, this QA program will be evaluated by DOE against the applicable criteria of the Nuclear Regulatory Commission (NRC) Review Plan: "Quality Assurance Programs for Site Characterization of High-Level Waste Repositories" (Reference 21).

3. Quality Assurance Plan

The Contractor shall prepare a Quality Assurance Plan that applies to all workscope performed under the contract. Insofar as QA requirements are different for the various system elements, the QA Plan shall indicate where documents or criteria apply. The QA Plan shall include criteria for determining applicability of specific QA requirements; i.e., establishment of a system for assignment of levels of QA to workscope.

The QA Plan shall identify and require development of implementing QA plans and procedures required for conduct of work in a matrix along with the organization responsible for preparing the document, organizations responsible for concurring on the document, organization responsible for approving the document, and whether or not the plan or procedure is required for the release to begin technical work.

The Contractor is responsible for preparing, distributing, controlling, and updating the QA Plan. DOE-HQ will approve the QA Plan, and any revisions.

E. MANAGEMENT CONTROL SYSTEM PROCEDURES

The purpose of these procedures is to ensure control of workscope and activities such that Program requirements are met. Procedures will implement requirements in the PMP, SEMP, and QA Plan.

The Contractor is responsible for preparing, distributing, controlling, and updating procedures applicable to work performed by the Contractor. Concurrence and approval of procedures will be completed in accordance with the PMP, SEMP, and QA Plan. As individual procedures are prepared and revised, they must be reviewed for consistency with the PMP, SEMP, and QA Plan and with other Contractor procedures. Procedures must be kept up to date and distribution must be controlled. Adherence to procedures will be a key element in audits and surveillances conducted by others.

The Contractor is responsible for training staff on the requirements in procedures and for establishing and maintaining records on training completed.

Procedures will focus on how work is to be performed including step-by-step description of activities. Procedures will also identify organizationally who is responsible for performing work.

Minimum contents requirements for procedures are as follows:

1) Purpose of procedure
2) Applicability
3) Requirements implemented/source of requirements
4) Responsibilities
5) Procedure/instructions
6) Records to be established and maintained/life of records

V. TRANSITION PERIOD

This section describes activities during the transition period when the Contractor is required to prepare for initiation of contract workscope. It also outlines the requirements and process for receipt for DOE authorization to begin technical workscope, and phase-in of work from existing contractors. A requirement is also established for the Contractor to assist in the transition of work to another contractor, if needed.

A. SUMMARY OF TRANSITION PERIOD

Initiation of all workscope described herein is anticipated to occur over a transition period. During the transition period, the Contractor will organize, staff, and equip the required offices; complete familiarization with the program; prepare a management system for controlling work; train staff; conduct a thorough review on readiness to begin technical work leading to DOE authorization to begin technical work; begin to assume responsibility for the Contractor workscope; and complete phase-in of work from existing contractors.

Figure V.1 illustrates the activities to be performed during the transition period leading to authorization to begin full phase-in of quality-affecting work by October 1, 1989.

A later transition of work from the Contractor to an MRS contractor may also occur.

B. TRANSITION PLAN

The Transition Plan in the Contractor's proposal shall be updated based on DOE comments and approved by DOE-HQ prior to staffing beyond key personnel and equipping the offices. Organizing, staffing, and equipping the offices shall be consistent with the Transition Plan, and with the Contract Schedule sections that specify locations of work to be performed, government-furnished property/facilities, and key personnel requirements. The Transition Plan shall cover the period of time from contract award to completion of phase-in from existing contractors. It is anticipated that this transition period will last approximately two to three years.

Information to be included, as a minimum, in the transition plan is as follows:

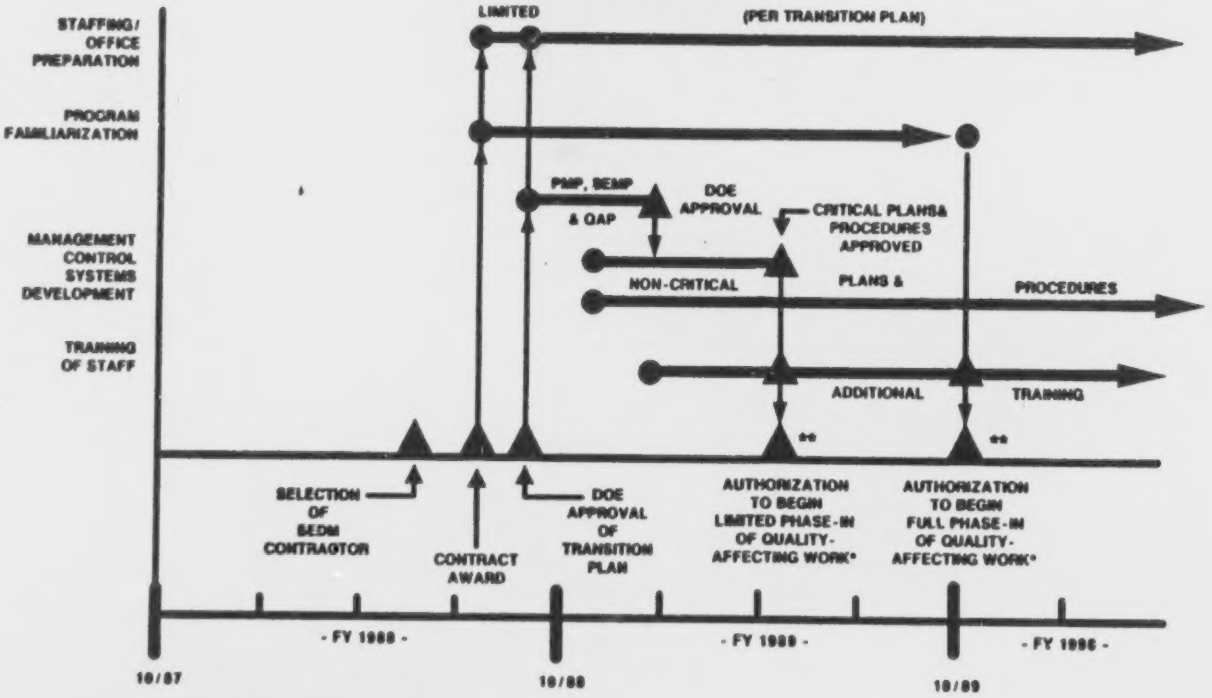
1) Organization

2) Staffing including types, numbers, and levels of personnel required and when personnel would be required

3) Office locations

4) Development/implementation of management control systems

FIGURE V.1
TRANSITION


STAFFING/ OFFICE PREPARATION
PROGRAM FAMILIARIZATION
MANAGEMENT CONTROL SYSTEMS DEVELOPMENT
TRAINING OF STAFF
LIMITED
(PER TRANSITION PLAN)
PMP, SEMP & QAP
DOE APPROVAL
CRITICAL PLANS& PROCEDURES APPROVED
NON-CRITICAL
PLANS &
PROCEDURES
ADDITIONAL
TRAINING
**
**
SELECTION OF SEDM CONTRACTOR
CONTRACT AWARD
DOE APPROVAL OF TRANSITION PLAN
AUTHORIZATION TO BEGIN LIMITED PHASE-IN OF QUALITY-AFFECTING WORK*
AUTHORIZATION TO BEGIN FULL PHASE-IN OF QUALITY-AFFECTING WORK*
- FY 1988 -
- FY 1989 -
- FY 1990 -
10/87
10/88
10/89

*SEE TABLE V.2 FOR IMPLEMENTATION OF WORK FROM EXISTING CONTRACTORS

**READINESS REVIEW(S) SUCCESSFULLY COMPLETED

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5) Approach to familiarization with completed and ongoing activities and existing planning, including interactions with existing DOE and contractor organizations.

6) Training

7) Readiness process to authorization to begin technical work

8) Milestones and schedules for all activities during the transition period.

C. AUTHORIZATION TO PERFORM TECHNICAL WORK

Establishment of the management control system shall also proceed in accordance with the transition plan. Before substantial work proceeds on detailed plans and procedures, the PMP, the SEMP, and the QA Plan should be issued at least once in draft form for review by Contractor staff followed by DOE to ensure they are integrated and meet DOE requirements.

The Contractor is not authorized to perform technical work with the exception of familiarization with the program until the management control system is in place and approved by DOE, the facilities and equipment are ready, and the staff is trained to the management system. On an exception basis by approval from DOE, other technical work may proceed provided it can be shown that the proposed work is not quality-affecting. Quality-affecting refers in general to the quality of items important to safety or important to waste isolation. It is not anticipated that validation of the performance measurement system will be a prerequisite for authorization to begin technical work.

In parallel with establishment of the management system, the contractor will assemble a Readiness Review Team that will assess readiness to begin technical work. The Contractor will also establish a training program to ensure training of staff on procedural requirements before authorization to begin technical work. The readiness review and training program will be conducted in accordance with approved procedures. Records of readiness and training will be prepared and maintained as specified by the procedures. When the SEDM Readiness Review Team has determined that the Contractor is ready to begin technical work, a recommendation report shall be submitted to the DOE Contracting Officer or his designee. The report shall recommend which work is ready to proceed, document the basis for conclusions, and the process utilized by the Readiness Review Team.

Interfacing between the contractor and DOE on the readiness process will be identified in DOE direction that will be prepared for the readiness review process. The DOE direction will identify the DOE readiness process and specific prerequisites to be met by the contractor prior to the authorization to perform technical work.

D. TRANSITION OF WORK TO THE SEDM CONTRACTOR

1. Status Of Existing Contracts

Table V.1 identifies major DOE contractors that are or will be performing work for the OCRWM Program.

Information is categorized by the WBS as follows:

a) Repositories
   - DOE-HQ
   - Salt Repository Project (SRP)
   - Basalt Waste Isolation Project (BWIP)
   - Nevada Nuclear Waste Storage Investigations Project (NNWSI)

b) Monitored Retrievable Storage

c) Transportation

d) Program Management

For these OCRWM Program areas, the table provides information on the name of the contractor, title/workscope, reference number to the OCRWM WBS, and contract period (both base and options, if any).

2. Transition Of Work To The SEDM Contractor.

The initial emphasis of the Contractor is to be on work related to the site characterization work for the three first repository candidate sites as described in the Site Characterization Plans, Site Characterization Plan Progress Reports, and the Study Plans. Following authorization to begin limited technical work, the Contractor shall be ready to initiate a formal evaluation of the site characterization program by mid-FY 1989. The Contractor shall conduct the evaluation in such a fashion that the results can be factored into the program prior to initiation of in-situ testing in the exploratory shaft facility at any of the first repository candidate sites.

By the end of FY 1989, the Contractor shall be ready to begin full phase-in of work from existing contractors, including engineering and design. In particular, the Contractor is responsible for the initiation of Advanced Conceptual Design (ACD) for the three first repository candidate sites. Such design will be initiated by the Contractor at the beginning of FY 1990. Prior to that, the Contractor will follow and monitor the pre-ACD engineering studies being conducted by the existing project design contractors. These pre-ACD engineering studies, which will focus on system and subsystem trade-off studies leading to preferred design options, will be documented by the existing contractors by the end of FY 1989. These studies will provide a firm basis for the Contractor to prepare the ACD, including drawings, specifications, cost/schedule estimates, and LAD design requirements.

Table V.2 identifies, for each existing major DOE contractor identified in Table V.1 above, which parts if any of the contractor's workscope is to be potentially turned over to the Contractor and approximately when the Contractor should be prepared to accept responsibility for the work. The Table also identifies deliverables from existing contractors expected to be available for use by the Contractor. This information is based on preliminary planning for the FY 1988 and FY 1989 budgets and will evolve as the Program matures.

For each of the transitions of work indicated, it is anticipated the existing contractor will provide support to the Contractor during the transition. It is anticipated that this support will begin before the scheduled phase-in period and will be available on an as-needed basis as long as the existing contract remains in effect.

E. TRANSITION OF SEDM CONTRACTOR WORK TO MRS CONTRACTOR

As indicated in the Introduction, the lead responsibility for MRS design and licensing may transfer to another contractor. If DOE selects this contractual approach, the Contractor will be required to assist in the transition of work to the other contractor.

TABLE V.1

MAJOR PRIME CONTRACTORS PERFORMING RELATED WORKSCOPE FOR
THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

CONTRACTOR NAME	SCOPE OF WORK/CONTRACT NUMBER/CONTRACT TITLE	WBS	WORKSCOPE PERFORMED FOR	CONTRACT PERIOD (BASE PLUS OPTIONS)
REPOSITORIES:				
Associated Universities, Inc.	Waste Package Scientific Support DE-AC02-76CH00016 "Operation of Brookhaven National Lab."	1.0	DOE-HQ	12/31/87*
Battelle Memorial Institute Pacific Northwest Division	Performance Assessment - DE-AC06-77RL01830 "Pacific Northwest Laboratory Operating & Management Contract"	1.0	DOE-HQ	09/30/89*
Associated Universities, Inc.	Preclosure Risk Assessment DE-AC02-76CH00016 "Operation of Brookhaven Nat'l Lab"	1.0	DOE-HQ	12/31/87*
Battelle Memorial Institute - Pacific Northwest Division	Materials Characterization Center DE-AC06-77RL01830 "Pacific Northwest Laboratory Operating & Management Contract"	1.0	DOE-HQ	09/30/89*
University of California Lawrence Berkeley Laboratory (LBL)	Geosciences Support DE-AC03-76SF00098 "Operation of Berkeley National Laboratory"	1.0	DOE-HQ	09/30/87*
SRA Technologies, Inc.	EIS Development DE-AC01-87RW00072 "Technical Support Services to Assist in the Planning and Scoping of an EIS and Implementation Plan for the the First High-Level Radioactive Waste Repository"	1.0	DOE-HQ	02/05/89 (with two 12-month options)

*Subject to 5-year renewal periods in accordance with FAR Part 17.6.

TABLE V.1

MAJOR PRIME CONTRACTORS PERFORMING RELATED WORKSCOPE FOR THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

CONTRACTOR NAME	SCOPE OF WORK/CONTRACT NUMBER/CONTRACT TITLE	WBS	WORKSCOPE PERFORMED FOR	CONTRACT PERIOD (BASE PLUS OPTIONS)
TBD	Design and Implementation of a Licensing Support System	1.0	DOE-HQ	TBD
Rockwell International Corp.	Integrating Contractor DE-AC06-77RL01030 "Hanford Site Operations Contract"	1.1 (All)	BWIP	06/28/87
Westinghouse Hanford Company	Integrating Contractor & Development Testing DE-AC06-86FF02170 "Hanford Operations and Engineering Contract"	1.1	BWIP	09/30/92*
MAC-Technical Services Company	Technical Support Services to DOE-RL DE-AC06-87RL10840 "Support Services for BWIP"	1.1 (All)	BWIP	03/31/90 (with seven 1-year options)
Battelle Memorial Institute Pacific Northwest Division	Research/Testing DE-AC06-77RL01830 "PNL Operating & Management Contract"	1.1	BWIP	09/30/89
Westinghouse Hanford Company	Development/Testing DE-AC06-76FF02170 "Management & Operation of the Hanford Engineering Development Laboratory"	1.1.2	BWIP	06/28/87
Kaiser Engineers/ Parsons-Brinckerhoff, Joint Venture	A/E Design (ESF and Repository DE-AC06-80RL10000 "A/E Services for BWIP"	1.1.2, 1.1.4, 1.1.6	BWIP	09/30/87 (with ESF Title III, ACD and FPC Design Options)
Morrison-Knudsen Company, Inc.	Construction Manager for ESF DE-AC06-80RL10343 "Construction Manager, BWIP"	1.1.6	BWIP	09/30/87 (with options for ESF and Repository Construction)

*Subject to 5-year renewal periods in accordance with FAR Part 17.6.

TABLE V.1

MAJOR PRIME CONTRACTORS PERFORMING RELATED WORKSCOPE FOR
THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

CONTRACTOR NAME	SCOPE OF WORK/CONTRACT NUMBER/CONTRACT TITLE	WBS	WORKSCOPE PERFORMED FOR	CONTRACT PERIOD (BASE PLUS OPTIONS)
Science Applications Int'l, Inc.	Technical & Management Support Services to DOE-NV DE-AC08-87NV10576 "Technical & Management Support Services for the DOE OCRWM Program Concerning Yucca Mt., Nye County, NV"	1.2 (All)	NNWSI	03/03/90 (with options to 03/97)
Reynolds Electrical & Engineering Co., Inc.	Logistics, maintenance, construction, & drilling support DE-AC08-84NV10327 "Weapons Test Support Services at Nevada Test Site and Other Assigned Locations"	1.2 (All)	NNWSI	09/30/88*
AT&T Technologies, Inc.	Performance assessment, systems, repository design DE-AC04-76DP00789 "Sandia National Laboratory Management & Operation"	1.2.1, 1.2.4	NNWSI	09/30/88*
University of California	Waste Package Design and Development W-7405-ENG-48 "Operation of Lawrence Livermore Nat'l Lab"	1.2.2	NNWSI	09/30/87*
Fenix & Scisson, Inc.	Engineering Support for drilling activities/subsurface design (ESF) DE-AC08-84NV10322 "Engineering Support for Drilling & Mining Activities"	1.2.3, 1.2.6	NNWSI	12/31/88
Holmes & Narver, Inc.	Surface Facility Design Support (ESF) DE-AC08-86NV10471 "Perform Management Engineering, Technical Support Communications, Constructions Material Testing, Operation & Maintenance Services"	1.2.3, 1.2.6	NNWSI	09/30/90

*Subject to 5-year renewal periods in accordance with FAR Part 17.6.

TABLE V.1

MAJOR PRIME CONTRACTORS PERFORMING RELATED WORKSCOPE FOR THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

CONTRACTOR NAME	SCOPE OF WORK/CONTRACT NUMBER/CONTRACT TITLE	WBS	WORKSCOPE PERFORMED FOR	CONTRACT PERIOD (BASE PLUS OPTIONS)
University of California	Geochemistry, radionuclide migration, and in-situ testing W-7405-ENG-36 "Los Alamos National Scientific Laboratory Management & Operation"	1.2.3, 1.2.6	NNWSI	09/30/87*
U.S. Department of Interior Geologic Survey	Geologic/hydrologic investigations DE-AI08-78EI44802 "Conduct Geologic, Geographical, Hydrologic, Seismological Investigation in the Support of DOE's Waste Management Activities"	1.2.3	NNWSI	12/31/99
Battelle Memorial Institute	Technical Integrator DE-AC02-83CH10140 "Management Activities for the DOE's Nat'l Waste Terminal Storage Program"	1.3(All)	SRP	09/30/87 (Recompetition now in progress, see next entry)
TBD	Integration Support Services (Request for Proposals)	1.3 (All)	SRP	10/01/87 thru 09/30/90 (with options up to seven years)
TBD	Technical & Field Services (Request for Proposals)	1.3 (All)	SRP	10/01/87 thru 09/30/90 (with options up to seven years)
Fluor Engineers & Constructors - Advanced Technology Division	Repository A/E Design DE-AC02-83WM46656 "A&E Conceptual Design of Waste Repository"	1.3.4	SRP	09/30/85 (Thru Conceptual Design with options for Title I and Title II designs)

*Subject to 5-year renewal periods in accordance with FAR Part 17.6

TABLE V.1

MAJOR PRIME CONTRACTORS PERFORMING RELATED WORKSCOPE FOR
THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

CONTRACTOR NAME	SCOPE OF WORK/CONTRACT NUMBER/CONTRACT TITLE	WBS	WORKSCOPE PERFORMED FOR	CONTRACT PERIOD (BASE PLUS OPTIONS)
Parsons-Redpath	Exploratory Shaft Facility (ESF) DE-AC02-83CH10125 "Construction Manager for Exploratory Shaft in Salt"	1.3.6	SRP	08/31/87 (Thru ESF Completion)
Parsons-Brinckerhoff/PB-KBB	ESF A/E Design DE-AC07-86WM46664 "A&E Contract for Exploratory Shaft Facilities"	1.3.6	SRP	05/01/88
Roy F. Weston, Inc.	OCRWM Technical Support Services DE-AC01-83NE44301 "Technical Support for the Coordination of Nat'l Waste Terminal Storage Program"	All	DOE-HQ	07/31/87
MONITORED RETRIEVABLE STORAGE:				
Roy F. Weston, Inc.	OCRWM Technical Support Services DE-AC01-83NE44301 "Technical Support for the Coordination of the Nat'l Waste Terminal Storage Program"	3.0	DOE-HQ	07/31/87
Battelle Memorial Institute - Pacific Northwest Division	MRS Technical Support DE-AC06-77RL01830 "Operation of Pacific Northwest Nat'l Labs"	3.0	RL	09/30/88*
Ralph M. Parsons Co.	Architect & Engineering Services DE-AC06-84RL10436 "A&E Services for Conceptual & Advanced Conceptual Design of Project 360 Monitored Retrieval Storage Facilities"	3.0	RL	09/30/87

*Subject to 5-year renewal periods in accordance with FAR Part 17.6.

TABLE V.1

MAJOR PRIME CONTRACTORS PERFORMING RELATED WORKSCOPE FOR
THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

CONTRACTOR NAME	SCOPE OF WORK/CONTRACT NUMBER/CONTRACT TITLE	WBS	WORKSCOPE PERFORMED FOR	CONTRACT PERIOD (BASE PLUS OPTIONS)
TRANSPORTATION				
Roy F. Weston, Inc.	OCRWM Technical Support Services DE-AC01-83NE44301 "Technical Support for the Coordination of the Nat'l Waste Terminal Storage Program"	4.0	DOE-HQ	07/31/87
EG&G Idaho, Inc.	Cask Development DE-AC07-76ID01570 "Prime Operating Contractor for the Idaho National Engineering Laboratory" (RFP DE-RP07-86ID12625 in progress)	4.1	ID	09/30/91*
AT&T Technologies, Inc.	Cask Development, Technical Support & Review DE-AC04-76DP00789 "Sandia National Laboratory Management & Operation"	4.1	ID	09/30/88*
Martin Marietta Energy Systems, Inc.	Transportation Operations Program Operations Planning DE-AC05-84R21400 "Oak Ridge Gaseous Diffusion Plant, Oak Ridge Nat'l Lab, Y-12 Plant, Paducah Gaseous Diffusion Plant, Management & Operation"	4.4	DOE-HQ	09/30/89*
Battelle Memorial Institute	Institutional Planning & Analysis Management Integration DE-AC01-83CH10139 "Crystalline Rock Project"	4.4	CH	09/30/88

*Subject to 5-year renewal periods in accordance with FAR Part 17.6

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TABLE V.1

MAJOR PRIME CONTRACTORS PERFORMING RELATED WORKSCOPE FOR
THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

CONTRACTOR NAME	SCOPE OF WORK/CONTRACT NUMBER/CONTRACT TITLE	WBS	WORKSCOPE PERFORMED FOR	CONTRACT PERIOD (BASE PLUS OPTIONS)
PROGRAM MANAGEMENT:				
Roy F. Weston, Inc.	OCRWM Technical Support Services DE-AC01-83NE44301 "Technical Support for the Coordination of Nat'l Waste Terminal Storage Program"	6.0	DOE-HQ	07/31/87
Martin Marietta Energy Systems, Inc.	Waste Systems Data & Development Program DE-AC05-84OR21400 "Oak Ridge Nat'l Lab. *et al.* Management & Operation"	6.0.2	OR	09/30/89*
Battelle Memorial Institute	Waste System Integration Support DE-AC06-77RL01830 "Pacific Northwest Laboratory Operating & Management Contract"	6.02	---	09/30/89

*Subject to 5-year renewal periods in accordance with FAR Part 17.6

TABLE V.2

POTENTIAL TRANSITION OF WORKSCOPE TO SEDM CONTRACTOR

CONTRACTOR NAME	SCOPE OF WORK/ CONTRACT NUMBER	ANTICIPATED PHASE-IN START DATE	POTENTIALLY AVAILABLE DELIVERABLES
REPOSITORIES:			
Associated Universities, Inc. [Brookhaven National Laboratory (BNL)]	Waste Package Scientific Support DE-AC02-76CH00017	FY 1989	---
Battelle Memorial Institute [Pacific Northwest Laboratory (PNL)]	Performance Assessment DE-AC06-77RL01830	FY 1990	---
Associated Universities, Inc. [BNL]	Preclosure Risk Assessment DE-AC02-76CH00016	FY 1989	---
Battelle Memorial Institute [PNL]	Materials Characterization Center (MCC) DE-AC06-77RL01830	None	- MCC Program Plan
University of California [Lawrence Berkeley Laboratory (LBL)]	Geosciences Support DE-AC03-76SF00098	FY 1989	---
SRA Technologies, Inc.	EIS Development DE-AC01-87RW00072	None	- EIS Scoping and Contents Requirements - EIS Annotated Table of Contents
TBD	Design and Implementation of a Licensing Support System	None	---
Rockwell Int'l Corp.	BWIP Integrating Contractor to 06/28/87 DE-AC06-77RL01030	See Westinghouse Hanford Company	See Westinghouse Hanford Company

TABLE V.2

POTENTIAL TRANSITION OF WORKSCOPE TO SEDM CONTRACTOR

CONTRACTOR NAME	SCOPE OF WORK/ CONTRACT NUMBER	ANTICIPATED PHASE-IN START DATE	POTENTIALLY AVAILABLE DELIVERABLES
Westinghouse Hanford Company	Integrating Contractor & Development/Testing DE-AC06-86FF02170	FY 1989 - Phase-in only of WBS elements assigned to SEDM in this SOW	GROUP: A - Systems Engineering Management Plan - Site-specific Systems Requirements Documents - Systems Description Documents - Reference Data Bases - Configuration Management Plan - Pre-ACD Waste Package Engineering studies Report - ACD Subsystem Requirements for Repository - Site characterization Plan & Semiannual updates - Final EMMP & SMMP - Outreach/Participation Plan - Project Plan - Project Management Plan - QA Plan GROUP B: - Waste Package SCP-CDR - ACD Subsystem Requirements for Waste Package - Waste Package Post-Closure Compliance Strategy Document - Waste Package Environment Scenario Document GROUP C: - Regional Hydrogic Model Status Report - Hydrochemical Data Base - Spent Fuel Rod Consolidation System Study

TABLE V.2

POTENTIAL TRANSITION OF WORKSCOPE TO SEDM CONTRACTOR

CONTRACTOR NAME	SCOPE OF WORK/ CONTRACT NUMBER	ANTICIPATED PHASE-IN START DATE	POTENTIALLY AVAILABLE DELIVERABLES
MAC-Technical Services Company	Technical Support Services to DOE-RL DE-AC06-87RL10840	None	---
Battelle Memorial Institute	BWIP Research/Testing DE-AC06-77RL01830	None	---
Kaiser Engineers, Inc./ Parsons-Brinckerhoff Joint Venture	BWIP A/E Design (ESF and Repository) DE-AC06-80RL10000	ESF - None Repository - at start of ACD (1990)	- BWIP ESF Title II Design Report BWIP SCP-CDR for Repository - Pre-ACD Repository Engineering Studies Report
Morrison-Knudsen Company Inc.	Construction Manager for BWIP ESF DE-AC01-80RL10343	None	---
Science Applications Int'l Inc.	Technical & Management Support Services to DOE-NV DE-AC08-83NV10576	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	- Site Characterization Plan and semiannual progress reports. - Final EMMP and SMMP - Outreach/Participation Plan - NNWSI Project Plan - NNWSI Project Management Plan - NNWSI QA Plan
Reynolds Electric & Engineering Co., Inc.	Logistics, maintenance, construction, & drilling support for NNWSI DE-AC08-84NV10327	None	---
AT&T Technologies, Inc. [Sandia National Lab.]	Performance assessment, systems, repository design DE-AC04-76DP00789	FY 1989	- NNWSI Systems Engineering Management Plan - Site-specific System Requirements Document - System Description Document - Reference Data Bases - Configuration Management Plan - Repository SCP-CDR - Spent Fuel Rod Consolidation System Study Report

TABLE V.2

POTENTIAL TRANSITION OF WORKSCOPE TO SEDM CONTRACTOR

CONTRACTOR NAME	SCOPE OF WORK/ CONTRACT NUMBER	ANTICIPATED PHASE-IN START DATE	POTENTIALLY AVAILABLE DELIVERABLES
			- Repository Seals Materials Selection Report - ACD Subsystem Design Requirements for Repository - Pre-ACD Repository Engineering Studies Report
University of California Lawrence Livermore National Laboratory (LLNL)	Waste Package Design and Development W-7405-ENG-48	FY 1990 - Waste Package Design at start of ACD	- Group B deliverables as listed for Westinghouse Hanford Co. - Ceramic Liner Feasibility Report
Fenix & Scisson, Inc.	Engineering Support for NNWSI drilling activities/subsurface design (ESF) DE-AC08-84NV10322	None	---
Holmes & Narver, Inc.	Surface Facility Design Support for NNWSI (ESF) DE-AC08-86NV10322	None	---
University of California Los Alamos National Laboratory (LANL)	Geochemistry, radionuclide migration, and in-situ testing W-7405-ENG-36	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	---
U.S. Department of Interior Geological Survey	Geologic/hydrologic investigations for NNWSI DE-AI-08-78EI44802	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	- Yucca Mountain Quaternary History - Natural Resources Evaluation
Battelle Memorial Institute (and Follow-on Awardee)	Technical Integrator DE-AC02-83CH10140 (Recompetition in progress)	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	GROUP A: - Systems Engineering Management Plan - Site-specific Systems Requireemnts Documents - Systems Description Documents

TABLE V.2

POTENTIAL TRANSITION OF WORKSCOPE TO SEDM CONTRACTOR

CONTRACTOR NAME	SCOPE OF WORK/ CONTRACT NUMBER	ANTICIPATED PHASE-IN START DATE	POTENTIALLY AVAILABLE DELIVERABLES
			- Reference Data Bases - Configuration Management Plan - Pre-ACD Waste Package Engineering Studies Report - ACD Subsystem Requireemnts for Repository - Site Characterization Plan & Semiannual updates - Final EMMP & SMMP - Outreach/Participation Plan - Project Plan - Project Management Plan - QA Plan GROUP B: - Waste Package SCP-CDR - ACD Subsystem Requirements for Waste Package - Waste Package Post-Closure compliance Strategy Document - Waste Package Environment Scenario Document GROUP C: - Waste Package Program Plan - Core Sample Management Plan - Geochemistry Test Plan - Surficial Geologic Mapping of Deaf Smith Site - Seismic Survey Report - Land Access Document for ESF

TABLE V.2

POTENTIAL TRANSITION OF WORKSCOPE TO SEDM CONTRACTOR

CONTRACTOR NAME	SCOPE OF WORK/ CONTRACT NUMBER	ANTICIPATED PHASE-IN START DATE	POTENTIALLY AVAILABLE DELIVERABLES
TBD	Integration Support Services (RFP) (for SRP)	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	---
TBD	Field & Technical Services (RFP) (for SRP)	None	---
Fluor Engineers & Constructors - Advanced Technology Division	Repository A/E Design DE-AC02-83WM46656	FY 1990 (ACD Start)	- Repository SCP-CDR - Spent Fuel Rod Consolidation Study Report - Pre-ACD Repository Engineering Studies Report
Parsons-Redpath	Exploratory Shaft Facility (ESF) Construction Manager and Operating Contractor DE-AC02-83CH10125	None	---
Parsons-Brinckerhoff/ PB-KBB	ESF A/E Design DE-AC07-86WM46664	None	- ESF Title II Design Report
Roy F. Weston, Inc.	OCRWM Technical Support Services DE-AC01-83NE44301	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	---
MONITORED RETRIEVABLE STORAGE:			
Roy F. Weston, Inc.	OCRWM Technical Support Services DE-AC01-83NE44301 "Technical Support for the Coordination of the Nat'l Waste Terminal Storage Program"	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	TBD
Battelle Pacific NW Labs	MRS Technical Support DE-AC06-77RL01830 "Operation of Pacific Northwest Nat'l Labs"	None	---

TABLE V.2

POTENTIAL TRANSITION OF WORKSCOPE TO SEDM CONTRACTOR

CONTRACTOR NAME	SCOPE OF WORK/ CONTRACT NUMBER	ANTICIPATED PHASE-IN START DATE	POTENTIALLY AVAILABLE DELIVERABLES
Ralph M. Parsons	Architect & Engineering Services DE-AC06-84RL10436 "A&E Services for Conceptual and Advanced Conceptual Design for Project 360-Monitored Retrievable Storage Facility"	None	---
TRANSPORTATION			
Roy F. Weston, Inc.	OCRWM Technical Support Services DE-AC01-83NE44301 "Technical Support for the Coordination of the Nat'l Waste Terminal Storage Program"	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	TBD
EG&G Idaho, Inc.	Cask Development DE-AC07-76ID01570 "Prime Operating Contractor for the Idaho National Engineering Laboratory"	None	---
AT&T Technologies, Inc.	Cask Development, Technical Support & Review DE-AC04-76DP00789 "Sandia National Laboratory Management & Operation"	None	---
Martin Marietta Energy Systems, Inc.	Transportation Operations Program Operations Planning DE-AC05-84R21400 "Oak Ridge Gaseous Diffusion Plant, Oak Ridge Nat'l Lab, Y-12 Plant, Paducah Gaseous Diffusion Plant, Management & Operation"	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	---

TABLE V.2

POTENTIAL TRANSITION OF WORKSCOPE TO SEDM CONTRACTOR

CONTRACTOR NAME	SCOPE OF WORK/ CONTRACT NUMBER	ANTICIPATED PHASE-IN START DATE	POTENTIALLY AVAILABLE DELIVERABLES
Battelle Memorial Institute	Institutional Planning & Analysis Management Integration DE-AC01-83CH10139 "Crystalline Rock Project"	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	---
PROGRAM MANAGEMENT:			
Roy F. Weston, Inc.	OCRWM Technical Support Services DE-AC01-83NE44301 "Technical Support for the Coordination of Nat'l Waste Terminal Storage Program"	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	---
Martin Marietta Energy Systems, Inc.	Waste Systems Data & Development Program DE-AC05-84OR21400 "Oak Ridge Nat'l Lab, et al. Management & Operation"	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	---
Battelle Memorial Institute	Waste System Integration Support DE-AC06-77RL01830 "Pacific Northwest Laboratory Operating & Management Contract"	FY 1989 Phase-in only of WBS elements assigned to SEDM in this SOW	---

APPENDIX A

- ACRONYMS -

ACD	Advanced Conceptual Design
BNL	Brookhaven National Laboratory
BWIP	Basalt Waste Isolation Project
CCB	Change Control Board
CFR	Code of Federal Regulations
CH	DOE-Chicago Operations Office
C/SCSC	Cost/Schedule Control System Criteria
DOE	U.S. Department of Energy
EIS	Environmental Impact Statement
EMMP	Environmental Monitoring and Mitigation Plan
EPA	U.S. Environmental Protection Agency
ESF	Exploratory Shaft Facility
FAR	Federal Acquisition Regulation
FPC	Final Procurement and Construction (Design)
HLW	High-Level Waste
HQ	Headquarters
ID	DOE-Idaho Operations Office
IMS	Information Management System
LA	License Application
LAD	License Application Design
LPM	Licensing Procedure Manual
LSS	Licensing Support System
MGDS	Mined Geologic Disposal System

MRS	Monitored Retrievable Storage
NNWSI	Nevada Nuclear Waste Storage Investigations
NRC	U.S. Nuclear Regulatory Commission
NV	DOE-Nevada Operations Office
NWPA	Nuclear Waste Policy Act of 1982 (Public Law 97-425)
OCRWM	DOE-Office of Civilian Radioactive Waste Management
OGR	DOE-Office of Geologic Repositories (within OCRWM)
OR	DOE-Oak Ridge Operations Office
PMP	Project Management Plan
PNL	Pacific Northwest Laboratory
QA	Quality Assurance
QAP	Quality Assurance Plan
RL	DOE-Richland Operations Office
SCP	Site Characterization Plan
SCP-CDR	Site Characterization Plan-Conceptual Design Report
SEDM	Systems Engineering, Development, and Management
SEMP	Systems Engineering Managment Plan
SMMP	Socioeconomic Monitoring and Mitigation Plan
SOW	Statement of Work
SRP	Salt Repository Project
TBD	To Be Determined
WBS	Work Breakdown Structure

APPENDIX B

- REFERENCES -

1. U.S. DOE, OCRWM Program Management System Manual
   January 1986
   (DOE/RW-0043)

2. U.S. DOE, OCRWM Draft Mission Plan Amendment
   January 1987
   (DOE/RW-0128)

3. U.S. DOE, ORCWM Monitored Retrievable Storage
   Submission to Congress
   March 1987
   (DOE/RW-0035/1-Rev.1)

4. U.S. DOE Order 4700.1, March 6, 1987, "Project Management System"

5. U.S. DOE, OCRWM
   Office of Geologic Repositories Work Breakdown Structure
   and Dictionary - Development and Evaluation Phase
   (OGR/B-4), November 1984

6. U.S. DOE, OCRWM Office of Geologic Repositories - Program Baseline
   Procedure Notebook (OGR/B-1) June 1986
   (DOE/RW-0068)

7. U.S. DOE, OCRWM
   Generic Requirements for a Mined Geologic Disposal System
   (OGR/B-2), June 1986
   (DOE/RW-0090)

8. U.S. DOE
   Memorandum, dated July 8, 1985
   Subject: Establishment of Waste Acceptance Process and Waste
   Acceptance Committee

9. U.S. DOE Solicitation DE-RP01-87RW0084,
   "Design and Implementation of a Licensing Support System"

10. U.S. DOE, OCRWM Mission Plan
    (Volume I, Part I, Chapter 4)
    June, 1985
    (DOE/RW-0005)

11. U.S. DOE OCRWM
    Systems Engineering Management Plan, October 1985
    (DOE/RW-0051)

12. U.S. DOE, OCRWM
Systems Engineering Management Plan for the Office of Geologic Repositories (OGR/B-7), October 1985

13. U.S. DOE Order DOE 5700.6B, September 23, 1986, "Quality Assurance"

14. U.S. DOE, OCRWM
Quality Assurance Management Policies and Requirements, October 1985
(DOE/RW-0032)

15. U.S. DOE, OCRWM
Office of Geologic Repositories, Quality Assurance Plan for High-Level Radioactive Waste Repositories
(OGR/B-3) August 1986
(DOE/RW-0095)

16. U.S. NRC, Title 10, Chapter 1, Part 60, Code of Federal Regulations-Energy, "Disposal of High Level Radioactive Waste in Geologic Repositories"

17. U.S. NRC, Title 10, Chapter 1, Part 50, Appendix B, Code of Federal Regulations-Energy, "Quality Assurance Criteria for Nuclear Power Plants"

18. U.S. NRC, Title 10, Chapter 1, Part 71, Code of Federal Regulations-Energy, "Packaging and Transportation of Radioactive Material"

19. U.S. NRC, Title 10, Chapter 1, Part 72, Code of Federal Regulation-Energy, "Licensing Requirements for the Storage of Spent Fuel in an Independent Spent Fuel Storage Installation (ISFSI)"

20. American National Standards Institute/American Society of Mechanical Engineers, Nuclear Quality Assurance-1, "Quality Assurance Program Requirements for Nuclear Facilities"

21. U.S. NRC Review Plan: Quality Assurance Programs for Site Characterization of High Level Nuclear Waste Repositories, June 1984

APPENDIX C

- MAJOR DELIVERABLES -

DESCRIPTION OF DELIVERABLE	WBS NUMBER	DUE DATE	DELIVERABLE APPROVED BY
Site-Specific System Requirements Documents - Update	1.X	FY 1992	DOE-HQ
Site-Specific System Description Documents - Update	1.X	1992	DOE-HQ
ACD Performance Assessment Report	1.X	1991	TBD
LAD Performance Assessment Report	1.X	1994	TBD
Performance Assessment System Model Validation Report	1.X	1992	DOE-HQ
Waste Package Materials Recommendation Report for ACD	1.X.02	1990	DOE-HQ
Waste Package Materials Recommendation Report for LAD	1.X.02	1992	DOE-HQ
Waste Package Container Design/Construction Standard	1.X.02	1990	DOE-HQ
Advanced Conceptual Design Report - Waste Package	1.X.02	1992	DOE-HQ
LAD Subsystems Design Requirements for Waste Package	1.X.02	1992	DOE-HQ
License Application Design Report for Waste Package	1.X.02	1994	DOE-HQ
Unsaturated Zone Modeling Evaluation Report - Tuff	1.2.02	1993	TBD
Groundwater Modeling Report for Draft EIS - BWIP	1.1.03	1992	TBD

Groundwater Modeling Report - Salt	1.3.03	1993	TBD
Groundwater Modeling Report for Draft EIS - Tuff	1.2.03	1993	TBD
Seals Materials Selection Reports for ACD	1.X.04	1990	TBD
Seals Materials Selection Reports for LAD	1.X.04	1991	TBD
Advanced Conceptual Design Report - Repository	1.X.04	1992	DOE-HQ
LAD Subsystem Requirements for Repository	1.X.04	1992	DOE-HQ
License Application Design Report for Repository and Seals	1.X.04	1994	DOE-HQ
Title III Inspection Reports	1.X.04	----	-----
Semi-annual SCP Progress Reports	1.X.05	1989 +	DOE-HQ
Evaluation Report of site-specific characterization programs	1.X.05	1989	DOE-HQ
Safety Analysis Report	1.X.05	1994	DOE-HQ
Site Selection Report	1.X.05	1995	DOE-HQ
In-situ (ESF) Testing Data and Analysis Report for LA	1.X.06	1994	DOE-HQ
Project Plan	--	1989	DOE-HQ
Project Management Plan	--	1989	DOE-HQ
Cost Plans	--	Annual	DOE-HQ
QA Plan	--	1989	DOE-HQ
Systems Engineering Management Plan	--	1989	DOE-HQ
Business, Project, and Technical Management Procedures	--	1989	DOE-HQ

Repository Licensing Topical Report(s)	1.X.05	TBD	DOE-HQ

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ORGANIZATIONAL CONFLICTS OF INTEREST GUIDELINES FOR THE SYSTEMS ENGINEERING, DEVELOPMENT, AND MANAGEMENT CONTRACTOR FOR THE OCRWM NUCLEAR WASTE MANAGEMENT SYSTEM

I. PURPOSE

The potential for organizational conflicts of interest (OCI) exists among a wide array of firms currently performing a diversity of OCRWM contract requirements and desiring to propose under the subject Request for Proposals (RFP). The contractors previously or currently performing evaluation services or activities, technical consulting and management support services and professional services, and other OCRWM contractual workscopes where special OCI provisions are included in the contract, and supporting the program at eight primary locations (Chicago, Nevada, Richland, Oak Ridge, Idaho, Albuquerque, San Francisco, and Headquarters), are faced with a potential OCI determination from a bias and/or an unfair competitive advantage standpoint with regard to their eligibility for award under the subject Source Evaluation Board (SEB) acquisition. The potential conflicts of interest may also apply to subcontractors and consultants at all eight locations. The primary purpose of this paper is to set forth guidelines addressing areas of potential organizational conflicts of interest.

The Government desires to conduct a full and open competition with the broadest participation by industry as is practical. There are numerous ongoing contracts and subcontracts related to areas of the SEB statement of work. The contractors performing these activities have the advantage of incumbency (the normal flow of benefits from the performance of the contract), which is recognized as a "fair" competitive advantage. In order to encourage the broadest competition, notwithstanding incumbency, ample information must be disseminated. Companies not currently performing work under OCRWM program contracts must decide whether to risk substantial bid and proposal costs, time, and energy to compete against incumbents. Hence, a secondary purpose of this paper is to announce the Department's intent to establish Public Reading Rooms for encouraging competition by providing ample information to all prospective bidders, including information not normally or otherwise made available under a competition. In summary, these guidelines provide a framework for uniform and equitable treatment of all prospective proposers under the subject RFP, address areas of potential conflicts of interest, and permit the widest competition possible under the subject RFP.

II. BACKGROUND OF THE REQUIREMENT

The Nuclear Waste Policy Act (NWPA) of 1982 established a national policy for safely storing, transporting, and disposing of spent nuclear fuel and high-level waste. Under the Act, DOE has the responsibilities to develop, schedule, site, construct, and operate deep-mined geologic waste repositories; and to perform research, development, and demonstration related to the disposal of spent fuel and high-level waste. In addition, the Act required the DOE to submit to Congress a proposal for the construction of a monitored retrievable storage facility for spent nuclear fuel and high-level waste.

In May 1986, the President approved the DOE recommendation that sites in Nevada, Texas, and Washington be selected for detailed characterization as candidate sites for the first repository. In addition to environmental and socioeconomic studies, the detailed site characterization process will involve constructing exploratory shafts between 1,000 and 4,000 feet deep to determine rock conditions at repository level. The extensive data to be collected during site characterization will be used in developing models to predict the performance of each site relative to the Nuclear Regulatory Commission (NRC) and Environmental Protection Agency (EPA) requirements and in conducting a comparative evaluation of the three candidate sites. In addition, development of a waste package and design of a repository suitable to each candidate site will be conducted and used in the comparative evaluation of the site. This site characterization process will culminate in both the preparation of an Environmental Impact Statement (EIS) evaluating the three candidate sites and the selection of one site for the first repository, for which a License Application will be submitted to the NRC. In accordance with the draft Mission Plan Amendment, the current DOE schedule calls for the EIS to be issued in October 1994, for the President to recommend a site for the first repository in November 1994, and for the License Application to be submitted in January 1995. Following a 3-year period for review of the License Application, construction of the first repository is scheduled to begin in January 1998, with initial operations in the year 2003.

The DOE Richland, Chicago, and Nevada Operations Offices have each been assigned project management responsibility by OCRWM and have each established a project office for one of the three candidate locations for siting a high level nuclear waste repository. To date, the Project Offices have been directing contractor performance of: characterization of their respective sites, design and construction of exploratory shafts, site-specific waste package and repository design and development, and compliance with environmental and licensing regulatory requirements. Several of the contractors are, under DOE direction, supporting the Project Offices in integrating the work of the numerous project participants, such as other DOE contractors, national laboratories, and interactions with state agencies and local governmental entities, and have assisted DOE in defining, planning, budgeting, scheduling, and executing site-specific project work.

Now that the initial programmatic requirements have been met, the increasing complexity of the repository program, and the need to ensure consistency among all of the critical elements and across all sites, requires a single management contractor to ensure:

- Consistency in critical test and evaluation work that will lead to both successful site selection and licensing.
- Improved specification of HQ requirements to project teams, leading to clearer understanding and improved performance.

- o Reduction/removal of duplication of work done for each of the candidate sites. Currently, three repository project offices are using different sets of contractors to design aspects of the repository that would be essentially the same at all sites.
- o Development of a single set of criteria and standards for site characterization and evaluation of test results; consistent application of criteria and standards across projects.
- o Centralization of management of key program and project priorities at Headquarters and increased project office focus on construction of facilities, data collection and preliminary analysis, and institutional interactions.

In the area of the Monitored Retrieval Storage (MRS) Facility, DOE has identified three potential sites for an MRS facility and site-specific designs are being prepared for a preferred site and two alternatives. These designs and plans for an MRS facility in the Nuclear Waste Management System were submitted to Congress on March 30, 1987, for authorization of an MRS facility. If approved by Congress, DOE plans to submit a License Application to the NRC thirty (30) months after Congressional approval. DOE anticipates an additional thirty (30) months for the NRC to review and approve the License Application before construction of the MRS facility would begin. Initial operation of the facility would start about 10 years after Congressional approval.

Finally, in the area of transportation responsibilities, OCRWM must develop a system to transport spent nuclear fuel and high-level radioactive waste to the Federal waste management facilities when they are able to receive it. A number of developmental studies are ongoing in this area.

III. STATEMENT OF WORK

The Contractor will be responsible for design and analysis of the Nuclear Waste Management System to ensure that the system is optimized and that the interfaces between the system elements are clearly specified and controlled, including transportation considerations. The Contractor will also be assigned specific responsibilities to ensure that the first repository candidate sites are characterized and that the selected site is engineered and developed through receipt of an NRC Construction Authorization. The Contractor will assist DOE in obtaining the NRC licenses. Beyond receipt of the Construction Authorization for the repository, the Contractor will be required to perform Title III Design and Inspection and to support DOE and the selected repository operator in obtaining the license to operate the first repository and in preparing for acceptance testing and operations. A primary aspect of the Contractor's responsibilities will be to ensure that all work is conducted in a structured and systematic manner that meets the technical, schedule, cost, safety, environmental, quality, and interface requirements and that it meets the regulatory requirements of the NRC and EPA.

The Contractor will be assigned responsibilities for the second repository in areas such as integrating second repository requirements with the other elements of the Nuclear Waste Management System and assisting second repository program participants to comply with the NWPA and ensure that techniques, strategy options, design concepts, and plans developed for the first repository are utilized where appropriate and that lessons learned on the first repository are incorporated into second repository planning and implementation.

Should DOE receive Congressional approval for the construction of a Monitored Retrievable Storage (MRS) facility as part of the Nuclear Waste Management System, the Contractor will be required to provide the design and licensing services for the MRS. The Contractor will provide the design and licensing services unless and until DOE makes a decision to transfer detailed design of the MRS to a separate requirement to be competed. The Contractor would be required to assist in the transition of that workscope to the other contractor. In any event, the Contractor will continue to retain the integration function of the MRS into the overall Nuclear Waste Management System.

The Contractor's responsibilities will include integrating the work of various program participants, such as national laboratories, other Federal agencies, and DOE prime contractors conducting work in support of the program. The Contractor will also assist DOE in its interaction with affected States and Indian Tribes to ensure that the consultation and cooperation required by the Act for its successful implementation is achieved. All responsibilities assigned to the Contractor will be subject to program authorization and technical direction by OCRWM.

IV. BACKGROUND TO OCI

In accordance with DEAR 909.570-4, two questions should generally be asked in determining whether OCI exists:

(1) Is the contractor being given an unfair competitive advantage in future work due to the performance of a particular contract?

(2) Are there conflicting roles or interests which might bias a contractor's judgment in relation to its work on a particular contract for the Department?

The ultimate determination as to whether OCI exists should be made in the light of common sense and good business judgment based upon the relevant facts and the work to be performed.

An unfair competitive advantage, as referenced in the first question above, would be present if situations envisioned by the Special OCI clause were present, such as: (1) award of a contract (other than for follow-on technical consulting and management support services) stemmed directly from a contractor's performance of technical consulting and management support services; (2) the Statement of Work or specification for a future competitive solicitation was prepared by an existing technical consulting and management support service contractor; (3) a present contractor with access to and use of DOE internal information which had not generally been made available to the public for at least six months used such information to compete for future DOE contract work.

In relation to the second question of bias, if one of the existing integration/technical support service contractors at a candidate repository site were to be successful in the subject SEB competition, a part of its responsibility would include the review and evaluation of data that was developed by it while continuing to provide services to the cognizant Project Office. Were this situation to arise, the issue would not be whether an apparent OCI is present; it clearly would be. The issue is, rather, the extent of conflict and whether it can be avoided. If such a conflict cannot be avoided, award might still be made in face of the conflict after a determination by the Secretary that award is otherwise in the best interest of the Government.

V. OCI GUIDELINES

A. Fair Competitive Advantage

Well over 100 prime contractors and subcontractors at the various Project Offices and other locations are performing work requirements generated by the OCRWM Program Office and related to the statement of work for this SEB. Most of this work involves the development of or access to information which gives rise to a "fair" competitive advantage (the normal flow of benefits from the performance of the contract). Notwithstanding this recognized fair advantage, in the interest of promoting full and open competition, the Public Reading Rooms for this SEB requirement contain a copy of the major prime contracts for contractors performing work related to this requirement and significant contract deliverables therefrom.

B. Unfair Competitive Advantage

Only a small amount of the OCRWM program work underway involves access to and use of information giving rise to an "unfair" competitive advantage. It is this much smaller universe of work to which the "unfair competitive advantage" under these Guidelines is directed.

The regulatory aspects of "unfair competitive advantage" are addressed at DEAR 909.5. The Department's Organizational Conflicts of Interest -- Special Clause at DEAR 952.209-72 (or DOE PR 9-1.5408-2) is included in many contracts and subcontracts awarded in response to OCRWM requirements to date and will be required for inclusion in many follow-on and other planned awards currently in progress. This clause, and the nature of the work accomplished under OCRWM contracts, have direct OCI implications for the subject SEB competition. Hereafter, this clause is referred to as the Special OCI clause. (See Enclosure 1.)

Subparagraph (b)(1)(i) of the Special OCI clause addresses ineligibility to participate in work which stems directly from other DOE contracts. Subparagraph (b)(1)(ii) addresses ineligibility to participate in work which is based on Statements of Work (SOW) or specifications prepared by the contractor and to be used in competitive procurements. The subject SOW did not stem directly from any existing contract. Furthermore, the SOW for the subject acquisition was exclusively prepared by the Government.

Subparagraph (b)(2)(i) of the Special OCI clause reads as follows:

> If the contractor, in the performance of this contract, obtains access to information, such as Departmental plans, policies, reports, studies, financial plans, internal data protected by the Privacy Act of 1974 (P.L. 93-579), or data which has not been released or otherwise made available to the public, the Contractor agrees that without prior written approval of the Contracting Officer it shall not: (a) use such information for any private purpose unless the information has been released or otherwise made available to the public; (b) compete for work for the Department based on such information for a period of six (6) months after either the completion of this contract or until such information is released or otherwise made available to the public, whichever is first; ...

Some information described under the above subparagraph (b)(2)(i) of the Special OCI clause under various DOE contracts could be of benefit to other potential proposers in the conduct of a full and open competition and will therefore be made available for review at Public Reading Rooms. Additionally, some contract deliverables under existing OCRWM contracts are pertinent and will also be made available for review at Public Reading Rooms by prospective offerors. Superior proposals and more meaningful competition should result from making this information available to all potential proposers.

Public Reading Rooms at three locations will be established by the SEB as the repository of information related to the Statement of Work for the Nuclear Waste Management System. The Reading Rooms will contain any (b)(2)(i)-type information under DOE contracts which is considered necessary to respond to the solicitation requirements. Additionally, the Reading Rooms will contain the major existing OCRWM prime contracts and pertinent deliverables. The information in the Reading Rooms, while not all-inclusive of already publicly available documents on the OCRWM program, will contain information which has not been previously released or otherwise made available to the public and which is considered necessary by the SEB to respond to the solicitation.

Potential proposers are cautioned that unless the (b)(2)(i)-type information is in the Reading Rooms, any proposer who has the Special OCI clause in his DOE contract or subcontract and has access to and the use of information under his DOE contract or subcontract which has not been released or otherwise made available to the public for at least six months as set forth in subparagraph (b)(2)(i) of the Special OCI clause, is prohibited from using such information in the competition for this requirement, without approval of his Contracting Officer.

Each proposer who has the Special OCI clause in his contract or subcontract and has access to and use of (b)(2)(i) type information as a result of the DOE contract or subcontract which has not been made public for at least six months, will be required to demonstrate as a part of his proposal that unless the (b)(2)(i)-type information is in the reading room for this SEB requirement and/or he has the Contracting Officer's approval, such information was not used in competing for this requirement.

C. Bias

The solicitation will require that all proposers provide a statement which describes all relevant factors concerning any past, present, or currently planned interest (financial, contractual, or organizational or otherwise) relating to the work to be performed under the instant OCRWM requirement and bearing on whether the offeror has a possible organizational conflict of interest with respect to being able to render impartial, technically sound, and objective assistance or advice. Every proposer will be required by the solicitation to fully disclose all relevant factors. Furthermore, proposers will be required to identify in the proposal specific plans to avoid or mitigate known conflicts of interest.

D. Proposal Preparation Conflicts

Proposers who are DOE contractors and subcontractors will also be required to demonstrate as part of the proposal how they avoided conflicts in the preparation of their proposal. Examples of actions to avoid conflicts include separation of personnel working under existing DOE contracts and subcontracts in any interval(s) during which they may be contributing to proposal preparation activities, controls on communication between proposal preparation personnel and personnel performing under existing DOE contracts and subcontracts, etc. During the interval(s) that personnel are utilized on proposal preparation activities, they must be separated from their Government contract activities, and all proposal preparation activities must be conducted in non-Government facilities.

Proposers having contractual obligations under existing contracts will be expected to minimize the impact under those existing contracts as a result of their choosing to participate in this competition. Performance of present contract responsibilities must continue to be the primary mission during the remaining term of the contract(s). Any such contractors or subcontractors are precluded by their contracts from directly charging existing contracts or subcontracts for the cost of preparing proposals for the SEB requirement, i.e., bid and proposal costs. The cognizant DOE Operations Offices have been requested to ensure that the contractors adhere to those provisions of their contracts.

E. Representations and Disclosures

All offerors will be required to follow existing administrative operating procedures which prescribe OCI Representation and Disclosure formats. Specifically, each offeror will be required to complete either the OCI Representation or Disclosure Statement, along with the questionnaire form set forth at Enclosure 2 to these Guidelines. Any additional questions required for the competition will be added to Enclosure 2 and incorporated in the solicitation.

F. Determinations Re: OCI

Potential proposers should be aware of the responsibilities of the SEB and Source Selection Official to evaluate all facts submitted in response to DEAR 909.570-15 and other solicitation requirements. Proposers are urged to read DOE Acquisition Regulation 909.570-9 before incurring proposal preparation expenses. If the Source Selection Official finds that an organizational conflicts of interest exists, the Contracting Officer shall:

(1) Disqualify the offeror from award; or

(2) Avoid such conflicts. Avoidance may be feasible in some cases by such actions as the inclusion of appropriate conditions in the resulting contract; having current contract(s) totally or partially terminated; independent review of work products; etc.; or

(3) If such conflicts cannot be avoided by an appropriate contract clause or other means, and the Secretary has, nevertheless, determined that award of the contract to the offeror is in the best interest of the U.S., the contract may be awarded.

Pursuant to the above, proposers are advised that organizational conflicts of interest may be a basis for disqualification from award.

Enclosures

ENCLOSURE 1
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DEAR 952.209-72 ORGANIZATIONAL CONFLICTS OF INTEREST-SPECIAL CLAUSE (APR 1984)

(a) Purpose. The primary purpose of this clause is to aid in ensuring that the Contractor (1) is not biased because of its past, present, or currently planned interests (financial, contractual, organizational, or otherwise) which relate to the work under this contract, and (2) does not obtain any unfair competitive advantage over other parties by virtue of its performance of this contract.

(b) Scope. The restrictions described herein shall apply to performance or participation by the Contractor and any of its affiliates or their successors in interest (hereinafter collectively referred to as "Contractor") in the activities covered by this clause as a prime Contractor, subcontractor, cosponsor, joint venturer, consultant, or in any similar capacity.

(1) Technical consulting and management support services.

(i) The Contractor shall be ineligible to participate in any capacity in Department contracts, subcontracts, or proposals therefor (solicited or unsolicited) which stem directly from the Contractor's performance of work under this contract. Furthermore, unless so directed in writing by the Contracting Officer, the Contractor shall not perform any technical consulting or management support services work under this contract on any of its products or services or the products or services of another firm if the Contractor is or has been substantially involved in their development or marketing. Nothing in this subparagraph shall preclude the Contractor from competing for follow-on contracts for technical consulting and management support services.

(ii) If the Contractor under this contract prepares a complete or essentially complete Statement of Work or specifications to be used in competitive procurements, the Contractor shall be ineligible to perform or participate in any capacity in any contractual effort which is based on such Statement of Work or specifications. The Contractor shall not incorporate its products or services in such Statement of Work or specifications unless so directed in writing by the Contracting Officer, in which case the restriction in this subparagraph shall not apply.

(iii) Nothing in this paragraph shall preclude the Contractor from offering or selling its standard commercial items to the Government.

(2) Access to and use of information.

(i) If the Contractor, in the performance of this contract, obtains access to information, such as Department plans, policies, reports, studies, financial plans, internal data protected by the Privacy Act of 1974 (Pub. L. 93-579), or data which has not been released or otherwise made available to the public, the Contractor agrees that without prior written approval of the Contracting Officer it shall not: (a) use such information for any private purpose unless the information has been released or otherwise made available to the public; (b) compete for work for the Department based on such information for a period of six (6) months after either the completion of this contract or until such information is release or otherwise made available to the public, whichever is first; (c) submit an unsolicited proposal to the Government which is based on such information until one year after such information is released or otherwise made available to the public; and (d) release such information unless such information has previously been released or otherwise made available to the public by the Department.

ENCLOSURE 1
Page 2 of 2

(ii) In addition, the Contractor agrees that to the extent it receives or is given access to proprietary data, data protected by the Privacy Act of 1974 (Pub. L. 93-579), or other confidential or privileged technical, business, or financial information under this contract, it shall treat such information in accordance with any restrictions imposed on such information.

(iii) The Contractor shall have, subject to patent, data, and security clauses of this contract, the right to use technical data it first produces under this contract for its private use, provided that, as of the date of such use all reporting requirements of this contract have been met.

(c) Disclosure after award. (1) The Contractor agrees that if after award it discovers an organizational conflict of interest with respect to this contract, an immediate and full disclosure shall be made in writing to the Contracting Officer which shall include a description of the action which the Contractor has taken or proposes to take to avoid or mitigate such conflicts. The Department may, however, terminate the contract for convenience if it deems such termination to be in the best interests of the Government.

(2) In the event that the Contractor was aware of an organizational conflict of interest prior to the award of this contract and did not disclose the conflict to the Contracting Officer, the Department may terminate the contract for default.

(d) Subcontracts. (1) The Contractor shall include this clause, including this paragraph, in subcontracts of any tier which involve performance or work of the type specified in (b)(1) above or access to information of the type covered in (b)(2) above. The terms "contract", "Contractor" and "Contracting Officer" shall be appropriately modified to preserve the Government's rights.

(2) If a subcontract is to be issued for evaluation services or activities, technical consulting or management support services work as defined at 909.570, the Contractor shall obtain for the Department a disclosure statement or representation, in accordance with DOE regulations in effect at the time, from each intended subcontractor or consultant. The Contractor shall not enter into any subcontract nor engage any consultant unless the Contracting Officer shall have first notified the Contractor that there is little or no likelihood that an organizational conflict of interest exists or that despite the existence of a conflict of interest the award is in the best interest of the Government.

(e) Remedies. For breach of any of the above restrictions or for nondisclosure or misrepresentation of any relevant facts required to be disclosed concerning this contract, the Government may terminate the contract for default, disqualify the Contractor for subsequent related contractual efforts and pursue such other remedies as may be permitted by law or this contract.

(f) Waiver. Requests for waiver under this clause shall be directed in writing to the Contracting Officer and shall include a full description of the requested waiver and the reasons in support thereof. If it is determined to be in the best interests of the Government, the Contracting Officer shall grant such a waiver in writing.

(g) Modification. Prior to a contract modification when the Statement of Work is modified to add new work, the period of performance is significantly increased, or the parties to the contract are changed, the Department will request and the Contractor is required to submit either an organizational conflict of interest disclosure or representation or an update of the previously submitted disclosure or representation.

ORGANIZATIONAL CONFLICTS OF INTEREST

REQUIREMENTS

In compliance with Public Law 95-39 (Sec. 401) and 95-70 (Section 10), and Department of Energy Acquisition Regulation (DEAR) 909.570 which implements these laws, your offer must provide the information and assurances called for by the forms provided in this section.

The offeror must submit (as a part of Volume I, Offer and Other Documents) the following documents from each of the entities 1/ listed below:

1. Either the Organizational Conflicts of Interest (OCI) (a) Representation Statement or (b) the Organizational Conflicts of Interest (OCI) Disclosure Statement. If the OCI Disclosure Statement is signed, provide an attachment showing the information required.

2. The OCI Questionnaire; If you answer any questions "yes," provide an attachment showing the information requested.

3. If applicable, a copy of the most current 10 K report submitted to the Securities and Exchange Commission (SEC) and the most current Annual Report.

1/ The types of entities or individuals which are required to complete the forms listed above are as follows:

1. The prime contractor. (If the offeror is a joint venture, consortium, or other similar type multiple entity organization, the information required should be provided for each member of the proposed organization, as appropriate.)

2. The subcontractor(s) (unless the subcontractor(s) is only providing supplies) and consultants at every tier.

3. All affiliates of the foregoing.

4. Any entities owned or represented by the chief executives or directors of: the prime contractor; any of the subcontractors, except for those only providing supplies; and any of the consultants.

5. Chief executives and directors - if they will be involved in performing the proposed work of: the prime contractor; the subcontractors at every tier (except for subcontractors which are only providing supplies); consultants at every tier: and all affiliates of the foregoing.

NOTICE

Apart from other remedies allowed by law or contract, any non-disclosure or misrepresentation of relevant facts required by the OCI regulations may result in the Department disqualifying the violator from future Department contracts.

Your attention is also directed to Part II, Section I, ORGANIZATIONAL CONFLICTS OF INTEREST - SPECIAL CLAUSE (DEAR 952.209-72).

DISCUSSION

It is the policy of the Department of Energy to identify and avoid or mitigate organizational conflicts of interest (OCI) before entering into contracts, agreements and other arrangements.

Generally, to determine whether an organizational conflict of interest exists, the Department considers these two questions:

- Are there conflicting roles which might bias a contractor's judgment in relation to its work for the Department?
- Is the contractor being given an unfair competitive advantage based on the performance of the contract?

Department personnel will examine with particular care proposed work that calls for advising, consulting, or evaluating in areas that will directly influence Departmental decisions about future procurements, R&D programs, production and regulatory activities.

Using common sense and good business judgment, the Contracting Officer will determine whether an organizational conflict of interest exists after examining all relevant facts submitted by the offeror; the statement of work; and information gained from other sources.

If a conflict does exist, the Contracting Officer:

- shall avoid any conflicts; or
- shall disqualify the offeror from award; or
- may award the contract if the Secretary (or Secretary's designee) determines that awarding the contract, despite the conflict, is in the best interest of the United States. Circumstances justifying such a determination include situations where "the Public exigency will not otherwise permit" and situations where the work or services cannot otherwise be obtained. In these cases, clauses are included in the contract to mitigate the conflict to the extent feasible and a notice of award is published in the *Federal Register*.

DEFINITIONS

1. The term "organizational conflicts of interest" means that a relationship or situation exists whereby an offeror or a contractor (including chief executives and directors, to the extent that they will or do become involved in the performance of the contract, and proposed consultants or subcontractors where they may be performing services similar to the services provided by the prime) has past, present, or currently planned interests that either directly or indirectly (through a client, contractual, financial, organizational or other relationship) may relate to the work to be performed under a Department contract and which (a) may diminish its capacity to give impartial, technically sound, objective assistance and advice, or (b) may result in it being an unfair competitive advantage. It does not include the normal flow of benefits from the performance of the contract.

2. The term "affiliates" means business concerns which are affiliates of each other when either directly or indirectly one concern or individual controls or has the power to control another, or when a third party controls or has the power to control both (See 41 CFR §1-1.601-1(e)).

3. The term "energy concern" as defined by Public Law 95-91, Section 601(b), includes:

   (a) Any person significantly engaged in the business of developing, extracting, producing, refining, transporting by pipeline, converting into synthetic fuel, distributing, or selling minerals for use as an energy source, or in the generation or transmission of energy from such minerals or from wastes or renewable resources;

   (b) Any Person holding an interest in property from which coal, natural gas, crude oil, nuclear material or a renewable resource is commercially produced or obtained;

   (c) Any person significantly engaged in the business of producing, generating, transmitting, distributing, or selling electric power;

   (d) Any Person significantly engaged in development production, processing, sale or distribution of nuclear materials, facilities or technology; and

   (e) Any person--

      (1) significantly engaged in the business of conducting research, development, or demonstration related to an activity described in paragraphs (a), (b), (c), (d); or

      (2) significantly engaged in conducting such research, development, or demonstration with financial assistance under any Act the functions of which are vested in or delegated or transferred to the Secretary of the Department of Energy.

COMPLETE ONE OR THE OTHER BUT NOT BOTH
Contract/Proposal/RFP# DE-______________

OCI REPRESENTATION STATEMENT

I hereby certify (or as a representative of my organization, I hereby certify) that, to the best of my knowledge and belief, no facts exist relevant to any past, present or currently planned interest or activity (financial, contractual, personal, organizational or otherwise) which relate to the proposed work; and bear on whether I have (or the organization has) a possible interest with respect to (1) being able to render impartial, technically sound, and objective assistance or advice; or (2) being given an unfair 2/ competitive advantage.

Signature: ______________________ Date: __________
Name: ______________________ Organization: __________
Title: ______________________ ______________________

OCI DISCLOSURE STATEMENT

I hereby certify (or as a representative of my organization, I hereby certify) that, to the best of my knowledge and belief, all relevant facts concerning past, present or currently planned interests or activities (financial, contractual, organizational or otherwise) which relate to the proposed work and bear on whether I have (or the organization has) a possible conflict of interest with respect to (1) being able to render impartial, technically sound, and objective assistance or advice, or (2) being given an unfair 2/ competitive advantage, are fully disclosed on the attached ___ page(s) and formatted to show:

- For ease of presentation, divide following data into four parts: Organizational, contractual, financial, other;
- The company, agency, organization in which you have a past, present, or currently planned interest or activity (financial, contractual, organizational, or otherwise);
- A brief description of relationship;
- A period of relationship;
- The extent of relationship (e.g., value of financial interest of work; percent of total holdings, total work, etc.).

Signature: ______________________ Date: __________
Name: ______________________ Organization: __________
Title: ______________________ ______________________

2/ An unfair competitive advantage does not include the normal flow of benefits from the performance of the contract.

Name of Person
or Organization: ____

OCI QUESTIONNAIRE

Contract/Proposal/RFP# DE-______________

1. Will you (or your organization) be involved in the performance of any portion of proposed work?

( ) No.
( ) Yes. The portion of the proposed work; the percentage value of the total effort; and the type of involvement are fully disclosed on the attached pages.

2. What is (are) the major type(s) of business conducted by you (or your organization)? Please reply on the attached pages.

3. Do you (or your organization) have any affiliates 3/?

( ) No.
( ) Yes. The name and a description of the major type(s) of business that each affiliate conducts is disclosed on the attached pages.

4. Will any of the following be involved in performing the proposed work: (a) any entities owned or represented by you (or your organization); (b) your organization's Chief Executive; any of its directors; or (c) any affiliates 3/?

( ) No.
( ) Yes. A full disclosure and discussion is given in the attached pages.

5. Are you (or your organization) an energy concern 3/?

( ) No.
( ) Yes. A full disclosure and discussion is given on the attached pages.

6. Do you (or your organization) have a direct or indirect relationship (financial, organizational, cotnractual, or otherwise) with any business entity which could be affected in any way by the selection of any particular site for a geologic repository?

( ) No.
( ) Yes. List the business entity(ies) showing the nature of your relationship and how it would be affected by the proposed work.

7. Other than Question 6. above, do you (or your organization) have a direct or indirect relationship (financial, organizational, contractual or otherwise) with any business entity which could be affected in any way by the proposed work?

( ) No.
( ) Yes. List the business entity(ies) showing the nature of your relationship and how it would be affected by the proposed work.

3/ See Definitions on Page 3 of 8.

Name of Person
or Organization: ______________________________

OCI QUESTIONNAIRE

8. What percentage of your total income for the current and preceding fiscal years resulted from arrangements with any of the entities identified in Questions 6 and 7 above?

__% For the current fiscal year--lasting from _/_/_ to _/_/_.

__% For the preceding fiscal year--lasting from _/_/_ to _/_/_.

9. Do you (or your organization) currently have or have you had during the past six (6) years any arrangements (for example, contracts and cooperative agreements) awarded, administered, or funded--wholly or partly--by the Department of Energy or any other Federal Agency which relate to the proposed Statement of Work?

( ) No.
( ) Yes. A full disclosure and discussion is given on the attached pages.

10. Do you (or your organization) have or have you ever had any contracts, agreements, special clauses, or other arrangements which prohibit you (or your organization) from proposing work to be performed in this solicitation or any portion thereof?

( ) No.
( ) Yes. A full disclosure and discussion is given on the attached pages.

11. Do you (or your organization) have any involvement with or interest (direct or indirect) in technologies which are or may be subjects of the contracts or which may be substitutable for such technologies?

( ) No.
( ) Yes. A full disclosure and discussion is given on the attached pages.

12. Could you (or your organization) in either your private or Government business pursuits utilize information acquired in the performance of the proposed work; such as:

(a) Data generated under the contract?
(b) Information concerning DOE plans and programs?
(c) Confidential and proprietary data of others?

( ) No.
( ) Yes. A full disclosure and discussion is given on the attached pages.

Name of Person
or Organization: ______________________________

OCI QUESTIONNAIRE

13. Under the proposed work, will you (or your organization) evaluate or inspect your own services or products, or the services or products of any other entity that has a relationship (e.g., client, organizational, financial, or other) with you (or your organization)? This could include evaluating or inspecting a competitor's goods and services.

( ) No.
( ) Yes. A full disclosure and discussion is given on the attached pages.

14. To avoid what you perceive as a possible organizational conflict of interest do you (or your organization) propose to: exclude portions of the proposed work; employ special clauses; or take other measures?

( ) No.
( ) Yes. A full discussion is given on the attached pages.
( ) No possibility of an organizational conflict of interest is perceived. This answer is briefly justified on the attached pages.

15. Please fully discuss in what manner you would propose to mitigate any conflict of interest which may exist if awarded a contract.

16. Was the information used in the preparation of your proposal in response to this RFP based in whole or in part on any information developed under a DOE contract with Special Contract Clause DEAR 952.209-72 (or DOE PR 9-1.5408-2) which has not been released or otherwise made available to the public for at least six months, or which has not been available under a contract expired for at least six months, whichever is first (except for information in the Reading Rooms for this RFP)?

( ) No.
( ) Yes. A full disclosure and discussion is given in the attached pages.

17. All offerors who were DOE contractors or subcontractors during the period of proposal preparation shall fully discuss the manner by which they avoided conflicts in the preparation of their proposal (e.g. separation of personnel working under existing DOE contracts and subcontracts in any interval(s) during which they contributed to proposal preparation activities, controls on communications between proposal preparation personnel and personnel performing under existing DOE contracts and subcontracts, etc.).

( ) Not applicable, not a DOE prime or subcontractor.
( ) A full discussion is given in the attached pages.

Page 8 of 8

Name of Person
or Organization: ______________________________

OCI QUESTIONNAIRE

I hereby certify that I have the authority to represent my organization, if applicable, and that, to the best of my knowledge and belief, the facts and representations presented on the three pages of this questionnaire and on the ____ pages of the attachment to it are accurate and complete.

Signature: ____________________ Date: ____________________

Name: ____________________ Organization: ____________________

Title: ____________________ ____________________

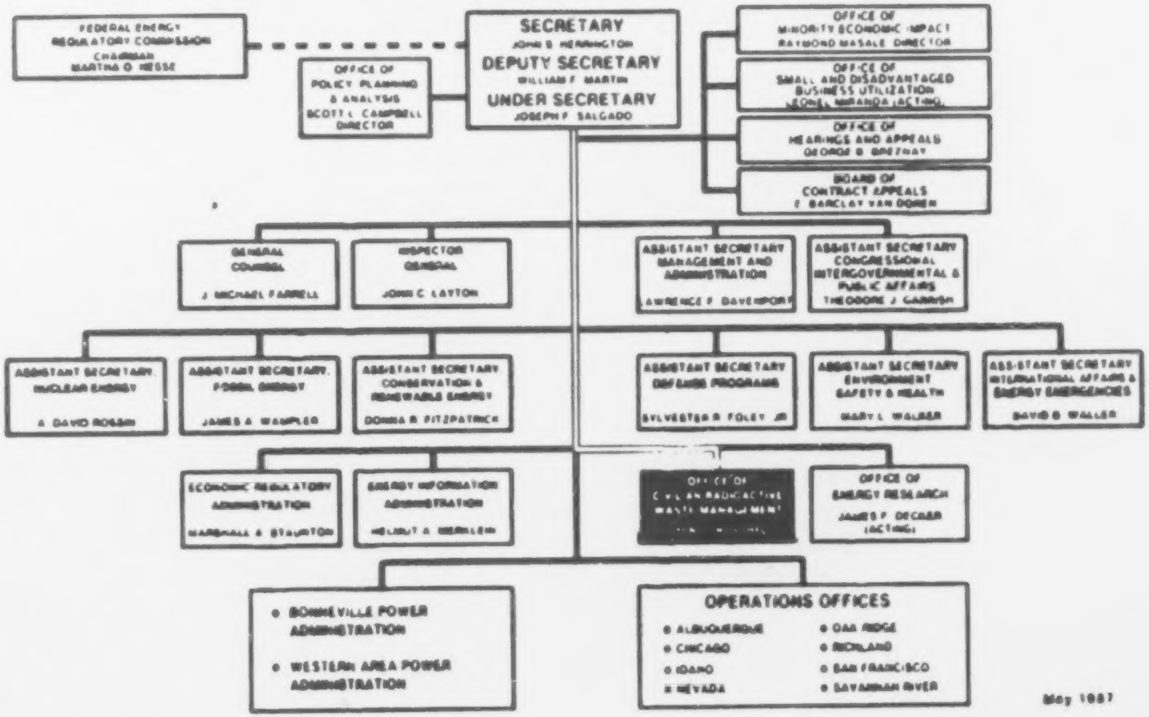
____

PRESOLICITATION PRESENTATION PACKAGE

U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
SYSTEMS ENGINEERING, DEVELOPMENT & MANAGEMENT CONTRACTOR
FOR THE NUCLEAR WASTE MANAGEMENT SYSTEM

JUNE 16, 1987

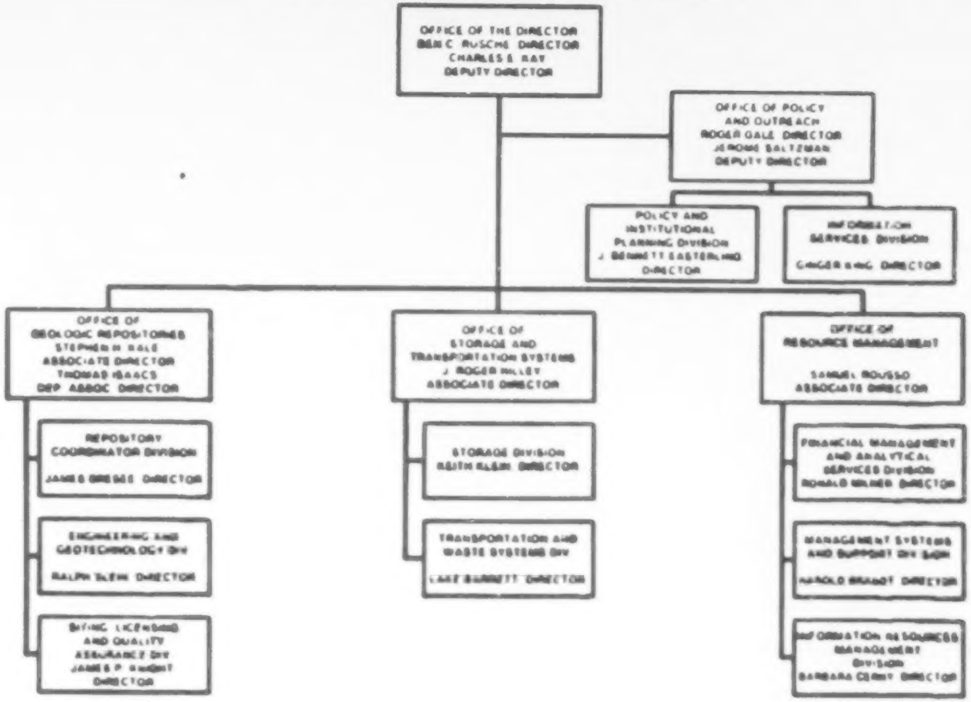
THE DEPARTMENT OF ENERGY


FEDERAL ENERGY REGULATORY COMMISSION
CHAIRMAN
MARTHA O HESSE
OFFICE OF POLICY PLANNING & ANALYSIS
SCOTT L CAMPBELL
DIRECTOR
SECRETARY
JOHN S HERRINGTON
DEPUTY SECRETARY
WILLIAM F MARTIN
UNDER SECRETARY
JOSEPH F SALGADO
OFFICE OF MINORITY ECONOMIC IMPACT
RAYMOND MASALE DIRECTOR
OFFICE OF SMALL AND DISADVANTAGED BUSINESS UTILIZATION
LEONEL MIRANDA (ACTING)
OFFICE OF HEARINGS AND APPEALS
GEORGE B BREZNAY
BOARD OF CONTRACT APPEALS
E BARCLAY VAN DOREN
GENERAL COUNSEL
J MICHAEL FARRELL
INSPECTOR GENERAL
JOHN C LAYTON
ASSISTANT SECRETARY MANAGEMENT AND ADMINISTRATION
LAWRENCE F DAVENPORT
ASSISTANT SECRETARY CONGRESSIONAL INTERGOVERNMENTAL & PUBLIC AFFAIRS
THEODORE J GARRISH
ASSISTANT SECRETARY NUCLEAR ENERGY
A DAVID ROSSIN
ASSISTANT SECRETARY FOSSIL ENERGY
JAMES A WAMPLER
ASSISTANT SECRETARY CONSERVATION & RENEWABLE ENERGY
DONNA R FITZPATRICK
ASSISTANT SECRETARY DEFENSE PROGRAMS
SYLVESTER R FOLEY JR
ASSISTANT SECRETARY ENVIRONMENT SAFETY & HEALTH
MARY L WALKER
ASSISTANT SECRETARY INTERNATIONAL AFFAIRS & ENERGY EMERGENCIES
DAVID B WALLER
ECONOMIC REGULATORY ADMINISTRATION
MARSHALL A STAUNTON
ENERGY INFORMATION ADMINISTRATION
HELMUT A MERKLEIN
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
OFFICE OF ENERGY RESEARCH
JAMES F DECKER
(ACTING)
BONNEVILLE POWER ADMINISTRATION
WESTERN AREA POWER ADMINISTRATION
OPERATIONS OFFICES
ALBUQUERQUE
CHICAGO
IDAHO
NEVADA
OAK RIDGE
RICHLAND
SAN FRANCISCO
SAVANNAH RIVER

May 1987

MAS1734T.004

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT


OFFICE OF THE DIRECTOR
BEN C. RUSCHE DIRECTOR
CHARLES E. RAY
DEPUTY DIRECTOR
OFFICE OF POLICY
AND OUTREACH
ROGER GALE DIRECTOR
JEROME SALTZMAN
DEPUTY DIRECTOR
POLICY AND
INSTITUTIONAL
PLANNING DIVISION
J. BENNETT EASTERLING
DIRECTOR
INFORMATION
SERVICES DIVISION
GINGER KING DIRECTOR
OFFICE OF
GEOLOGIC REPOSITORIES
STEPHEN H. KALE
ASSOCIATE DIRECTOR
THOMAS ISAACS
DEP. ASSOC. DIRECTOR
REPOSITORY
COORDINATOR DIVISION
JAMES BRESEE DIRECTOR
ENGINEERING AND
GEOTECHNOLOGY DIV
RALPH STEIN DIRECTOR
SITING, LICENSING
AND QUALITY
ASSURANCE DIV
JAMES P. KNIGHT
DIRECTOR
OFFICE OF
STORAGE AND
TRANSPORTATION SYSTEMS
J. ROGER HILLEY
ASSOCIATE DIRECTOR
STORAGE DIVISION
KEITH KLEIN DIRECTOR
TRANSPORTATION AND
WASTE SYSTEMS DIV
LAKE BARRETT DIRECTOR
OFFICE OF
RESOURCE MANAGEMENT
SAMUEL ROUSSO
ASSOCIATE DIRECTOR
FINANCIAL MANAGEMENT
AND ANALYTICAL
SERVICES DIVISION
RONALD MILNER DIRECTOR
MANAGEMENT SYSTEMS
AND SUPPORT DIVISION
HAROLD BRANDT DIRECTOR
INFORMATION RESOURCES
MANAGEMENT
DIVISION
BARBARA CERNY DIRECTOR

MAS1734T.008

FY 1988 CONGRESSIONAL BUDGET
NUCLEAR WASTE FUND

($ IN THOUSANDS)

	FY 1987 APPROP.	FY 1988 REQUEST
NUCLEAR WASTE FUND		
REPOSITORY DEVELOPMENT		
• FIRST REPOSITORY	$307,446	$525,044
• SECOND REPOSITORY	19,800	24,000
MONITORED RETRIEVABLE STORAGE	20,000	58,000
TRANSPORTATION AND SYSTEMS INTEGRATION	26,000	63,043
PROGRAM MANAGEMENT AND TECHNICAL SUPPORT	46,754	54,913
	79,000	
TOTAL	$499,000	$725,000
LESS		225,000
FY 1988 CONGRESSIONAL BUDGET REQUEST		$500,000

MA51734T.089

NUCLEAR WASTE MANAGEMENT PROGRAM

J. ROGER HILLEY

ASSOCIATE DIRECTOR FOR
STORAGE AND TRANSPORTATION
SYSTEMS

OFFICE OF CIVILIAN RADIOACTIVE
WASTE MANAGEMENT

MAS1734T.013

NUCLEAR WASTE POLICY ACT OF 1982

- TO SITE, LICENSE, CONSTRUCT AND OPERATE REPOSITORIES FOR THE DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTE
- TO ESTABLISH THE NUCLEAR WASTE FUND SO THAT OWNERS AND GENERATORS OF WASTE WILL PAY THE COST OF PROGRAM
- TO DEFINE THE RELATIONSHIP BETWEEN THE FEDERAL GOVERNMENT AND STATES AND INDIAN TRIBES
- TO PROVIDE A LIMITED AMOUNT OF FEDERAL INTERIM STORAGE CAPABILITY
- TO STUDY THE NEED FOR AND FEASIBILITY OF MONITORED RETRIEVABLE STORAGE

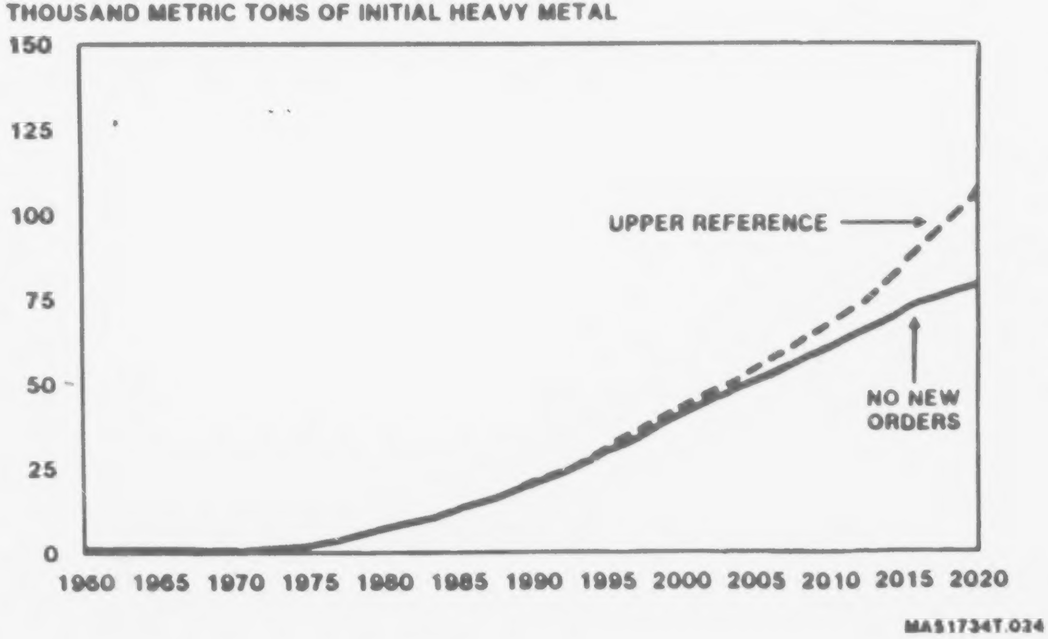
MAS1734T.014

NUCLEAR WASTE MANAGEMENT PROGRAM POLICY GOALS

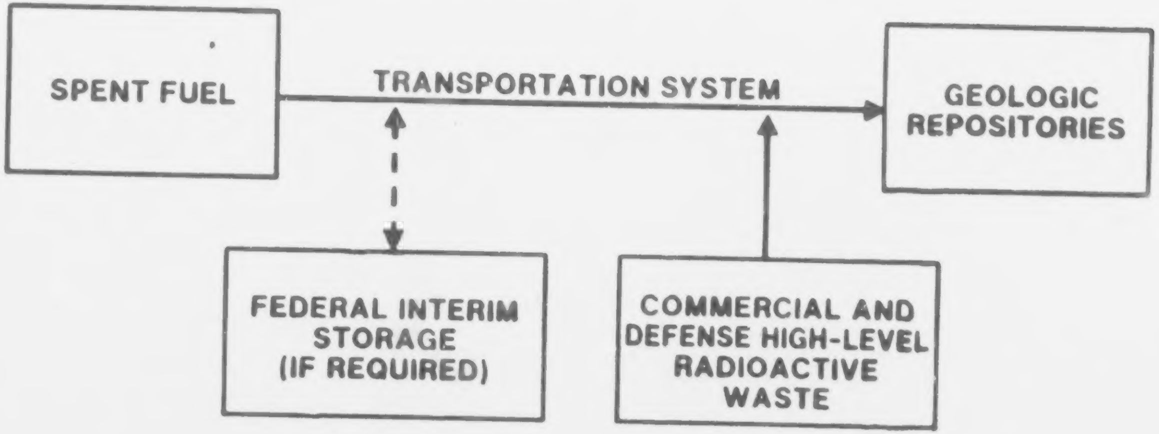
- THE PROTECTION OF PUBLIC HEALTH AND SAFETY AND ENVIRONMENTAL ACCEPTABILITY ARE OF PARAMOUNT IMPORTANCE
- THE PROGRAM MUST BE CREDIBLE TO THE PUBLIC BY VIRTUE OF ITS INTEGRITY AND TECHNICAL EXCELLENCE
- THE PROGRAM MUST NEITHER SUBSIDIZE NOR PENALIZE NUCLEAR POWER AS AN ENERGY SOURCE
- THE PROGRAM MUST BE CONDUCTED IN A COST-EFFECTIVE MANNER, WITH FULL COST RECOVERY

MAS1734T.012

U.S. TOTAL NUCLEAR SPENT FUEL DISCHARGES
1960-2020



THE WASTE-DISPOSAL SYSTEM CURRENTLY AUTHORIZED BY CONGRESS



SPENT FUEL

TRANSPORTATION SYSTEM

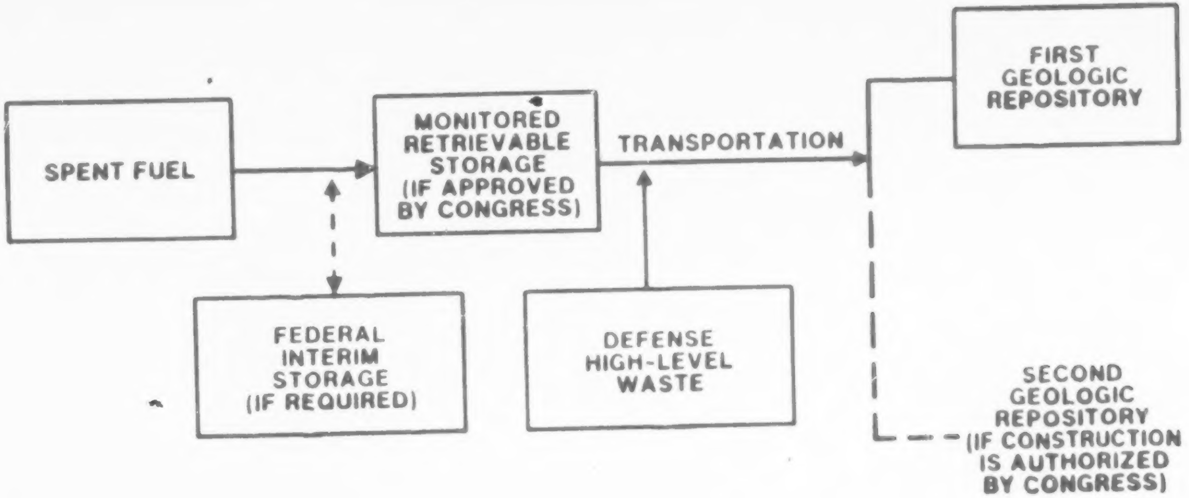
GEOLOGIC REPOSITORIES

FEDERAL INTERIM STORAGE (IF REQUIRED)

COMMERCIAL AND DEFENSE HIGH-LEVEL RADIOACTIVE WASTE

MA51734T.025

THE IMPROVED-PERFORMANCE WASTE-MANAGEMENT SYSTEM WITH AN INTEGRAL MRS FACILITY



SPENT FUEL

MONITORED RETRIEVABLE STORAGE (IF APPROVED BY CONGRESS)

TRANSPORTATION

FIRST GEOLOGIC REPOSITORY

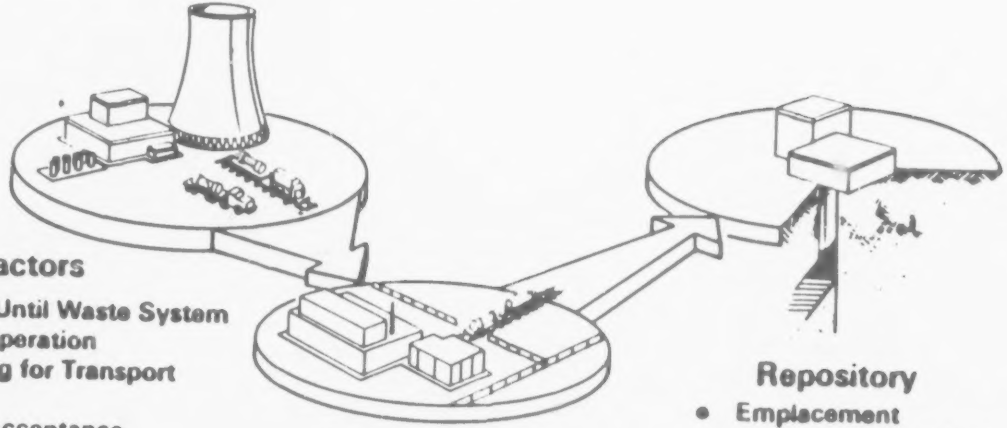
FEDERAL INTERIM STORAGE (IF REQUIRED)

DEFENSE HIGH-LEVEL WASTE

SECOND GEOLOGIC REPOSITORY (IF CONSTRUCTION IS AUTHORIZED BY CONGRESS)

MA51734T 026

Distribution of Waste Management Functions in a System With an Integrated MRS Facility



Reactors

- Storage Until Waste System Begins Operation
- Packaging for Transport to MRS
- Federal Acceptance

MRS Facility

- Managing At-Reactor SF Acceptance
- Scheduling and Controlling Transport to MRS
- SF Receipt, Inspection and Accounting
- Consolidation, Packaging and Conditioning for Disposal
- Monitored, Retrievable Storage
- Controlling Transport to Repository
- Special Packaging, Repair and Testing

Repository

- Emplacement
- Long-Term Containment

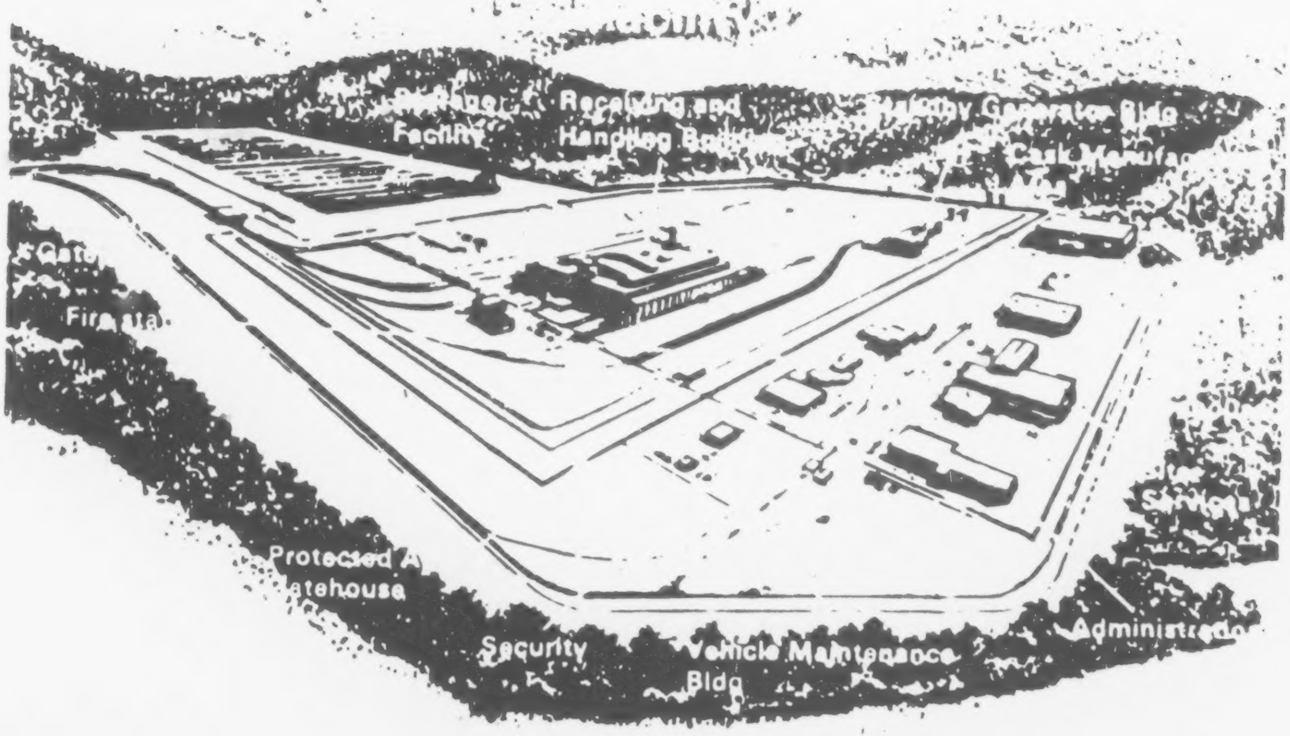
Legend:

MRS - Monitored Retrievable Storage

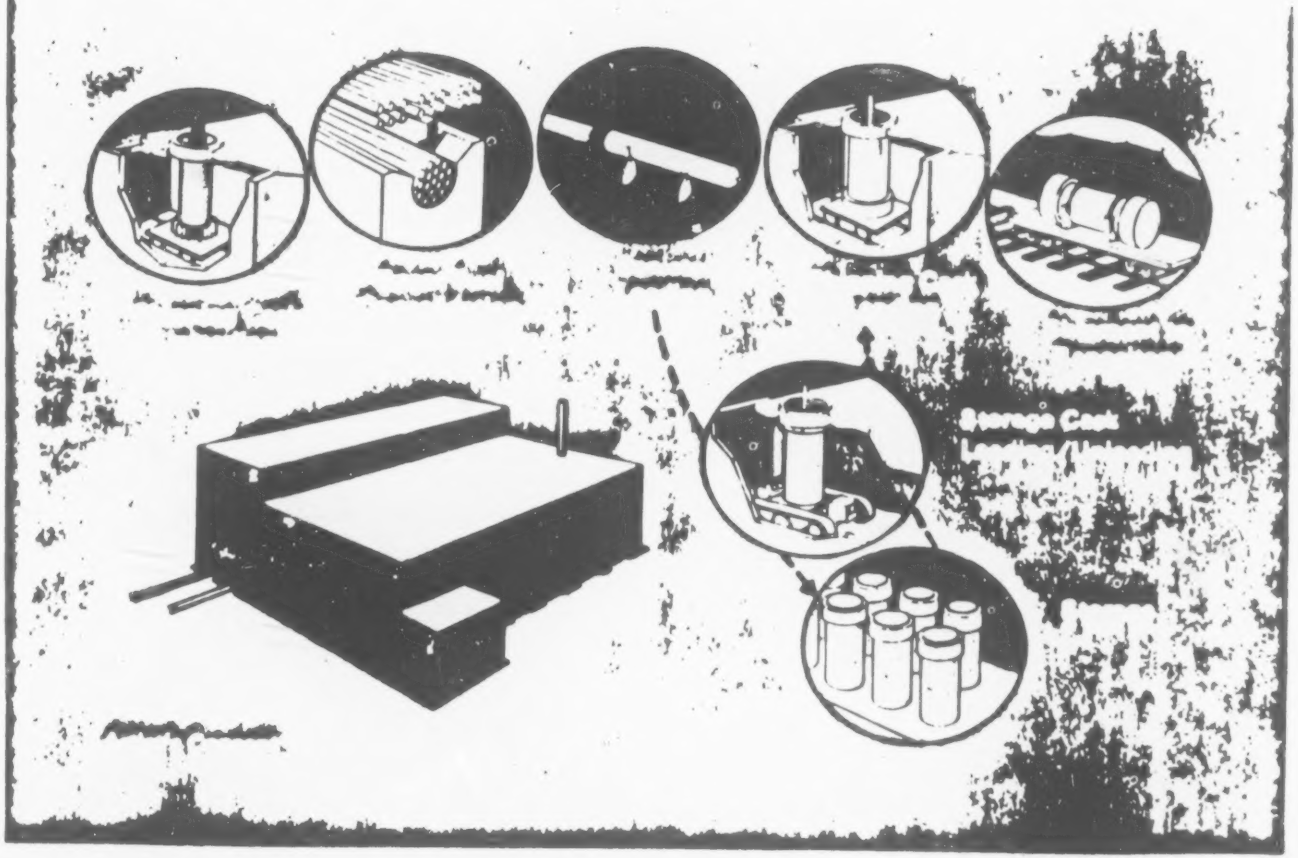
SF - Spent Fuel

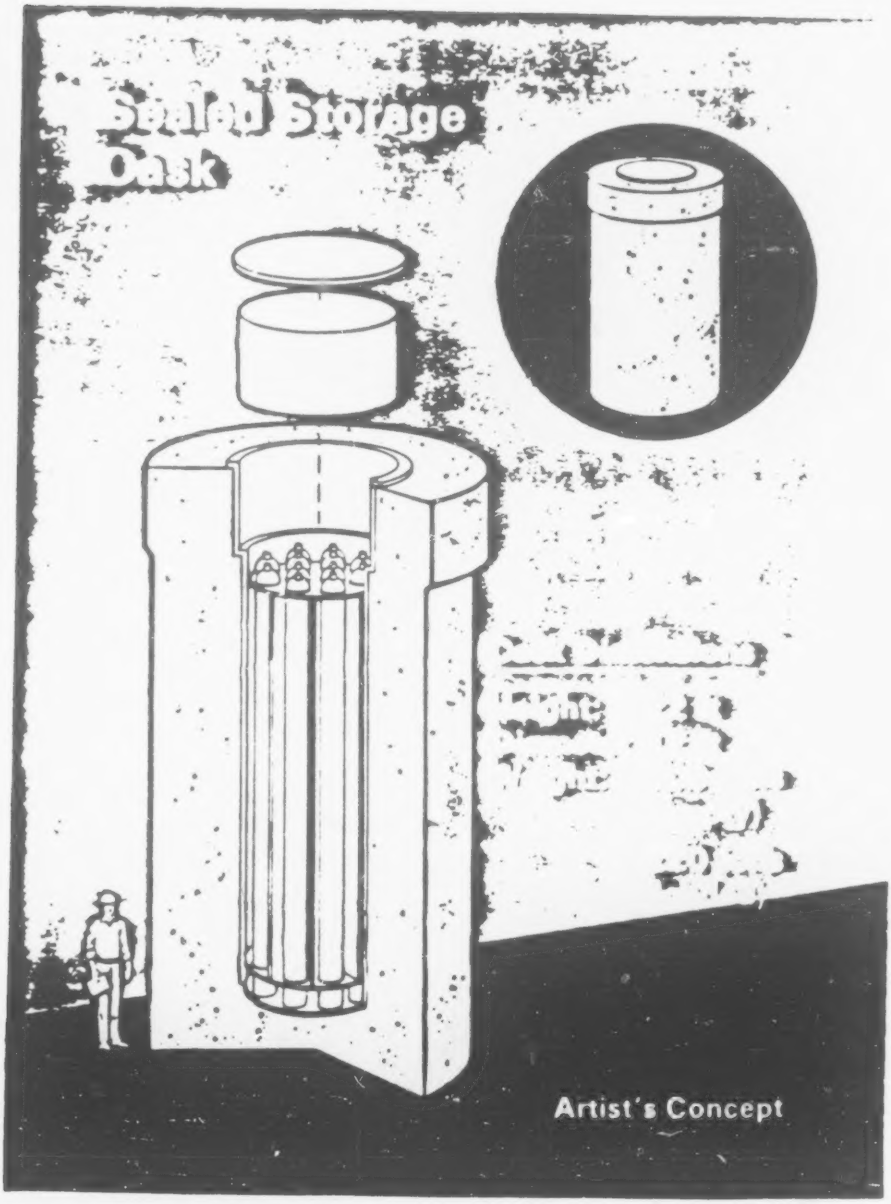
OFFICE OF STORAGE AND TRANSPORTATION SYSTEMS

- MONITORED RETRIEVABLE STORAGE
- TRANSPORTATION
- SYSTEMS INTEGRATION


Facility
Receiving and
Handling Buil
Generator Bldg
Cask Manufa
Gate
Fire Sta
Protected A
atehouse
Security
Vehicle Maintenance
Bldg
Administratio
Services

[illegible]


Storage Cask
Loading/Unloading


Sealed Storage Cask
Artist's Concept

PRINCIPLE APPLICABLE NRC REGULATIONS FOR MRS

● 10 CFR 72	LICENSING REQUIREMENTS FOR THE INDEPENDENT SPENT FUEL STORAGE INSTALLATION
● 10 CFR 50	FOR QUALITY ASSURANCE
● 10 CFR 20	FOR RADIOLOGICAL SAFETY
● 10 CFR 73	FOR SECURITY AND SAFEGUARDS

MA51734T.016

Principal Design Criteria

● Minimum receipt and shipment rates	2500 MTU/yr
● In-building lag storage capacity	1000 MTU
● Sealed storage cask capacity	15,000 MTU
● Capable of consolidating SF rods and hardware into storage canisters	
● Provide space for adding repository overpack	
● Handle PWR (60 wt%) and BWR (40 wt%)	
● Receive shipments by rail (70 wt%) and truck (30 wt%)	
● Burnup of SF - PWR (nominal)	33,000 MWd/MTU
- BWR (nominal)	28,000 MWd/MTU
● Age of SF (nominal)	10 years
● Minimum age of SF	5 years

MRS PROPOSAL

SUBMITTED ON MARCH 31, 1987
DOE PROPOSES THAT CONGRESS

- APPROVE CONSTRUCTION AT THE CLINCH RIVER SITE AT OAK RIDGE, TENNESSEE
- LIMIT STORAGE TO 15,000 MTU OF SPENT NUCLEAR FUEL
- PRECLUDE ACCEPTANCE OF SPENT FUEL UNTIL NRC AUTHORIZES CONSTRUCTION OF REPOSITORY
- DIRECT DOE TO IMPLEMENT MEASURES RESPONSIVE TO RECOMMENDATIONS OF THE STATE AND LOCAL GOVERNMENTS
- DIRECT DOE TO IMPLEMENT THE PROGRAM PLAN IN THE PROPOSAL

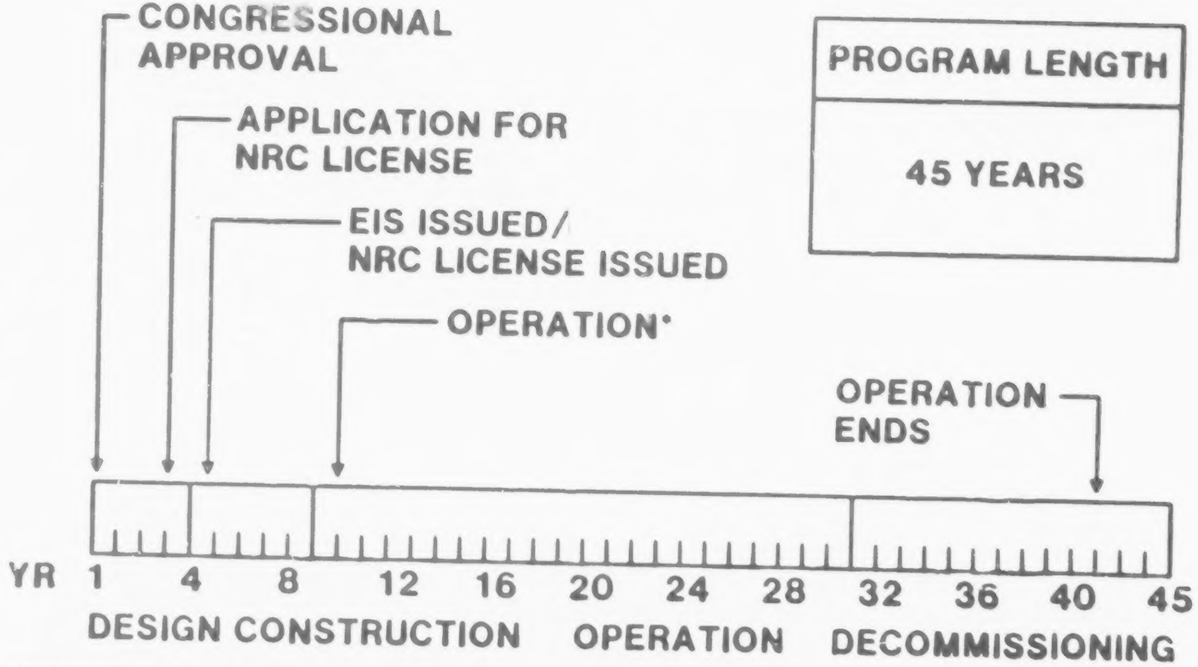
MA51734T.017

MRS Proposal (cont'd)

Financial Assistance

- Annual assistance
    - Mitigation of impacts after congressional approval
    - Payments equivalent to taxes after construction
- Encourage diversification of local industry
- Reimbursement of direct expenses
- Use of local suppliers
- Consider excess land for industrial development

MRS DEPLOYMENT SCHEDULE



CONGRESSIONAL APPROVAL

APPLICATION FOR NRC LICENSE

EIS ISSUED/ NRC LICENSE ISSUED

OPERATION*

OPERATION ENDS

PROGRAM LENGTH
45 YEARS

YR 1 4 8 12 16 20 24 28 32 36 40 45

DESIGN CONSTRUCTION OPERATION DECOMMISSIONING

*SHIPMENT OF SPENT FUEL TO MRS CONTINGENT UPON RECEIPT OF THE REPOSITORY CONSTRUCTION AUTHORIZATION.

MA51734T.023

MRS Proposal (cont'd)

Institutional Provisions

- Consultation and cooperation agreement
- Financial assistance
- State and local involvement

ESTIMATED LIFE CYCLE COSTS OF MRS

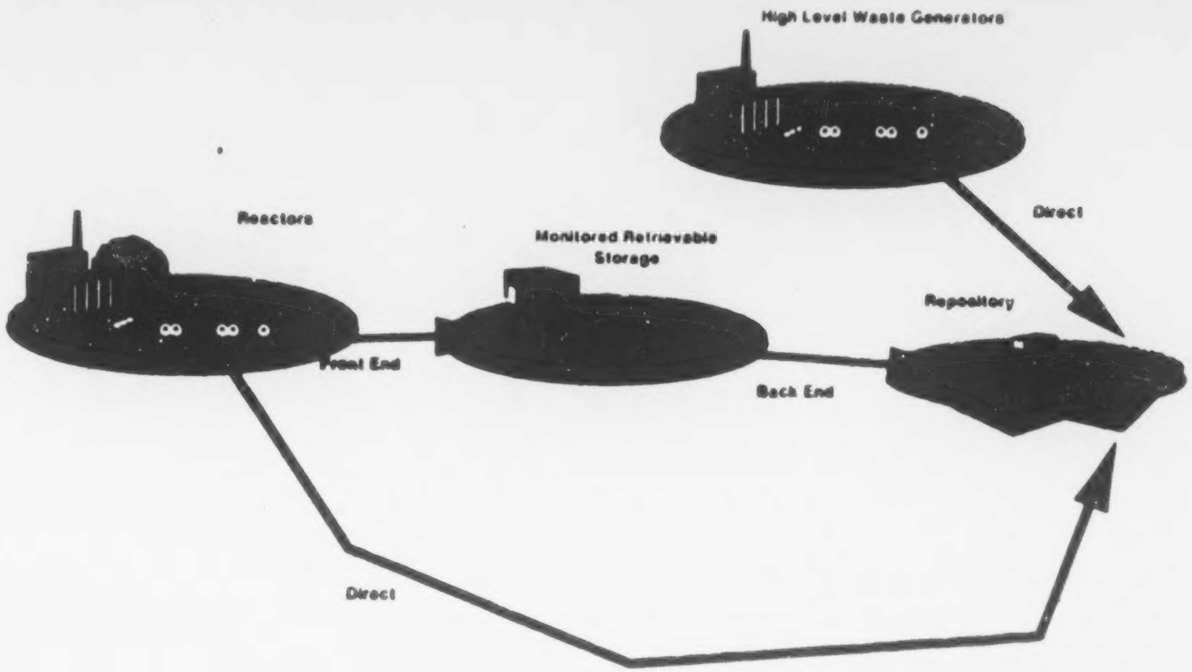
COST ELEMENT	CONSTANT 1986 DOLLARS (MILLIONS)
ENVIRONMENTAL EVALUATIONS	5.5
DESIGN	98.8
REGULATORY COMPLIANCE	28.4
CONSTRUCTION	655.0
TRAINING AND TESTING	62.8
OPERATION	2218.1
DECOMMISSIONING	83.0
INSTITUTIONAL INTERACTIONS	2.2
PROGRAM MANAGEMENT	70.8
TOTAL MRS FACILITY	3224.5

MA51734T.018

TRANSPORTATION ASPECTS OF NWPA

- DOE RESPONSIBLE
- DOE TAKES TITLE TO FUEL
- MAXIMUM USE OF INDUSTRY
- NUCLEAR REGULATORY COMMISSION CERTIFIES CASKS
- WASTE FUND PAYS FOR TRANSPORT

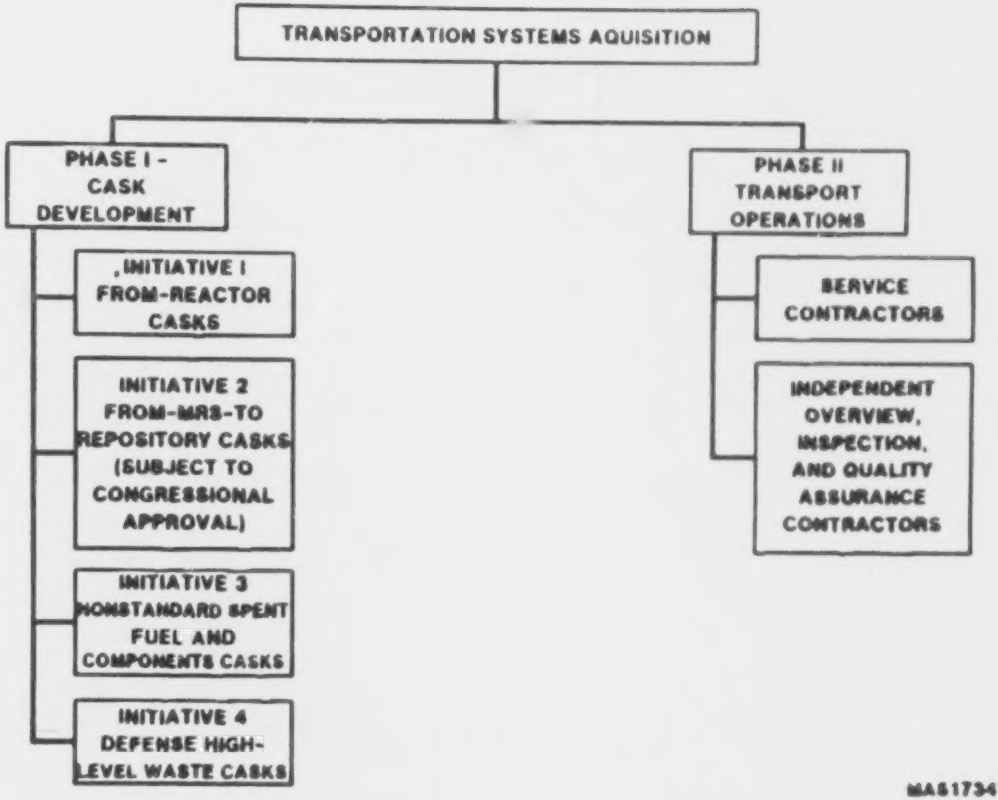
TRANSPORTATION SYSTEM DESCRIPTION


High Level Waste Generators
Direct
Reactors
Monitored Retrievable Storage
Repository
Front End
Back End
Direct

MAS1734T.006

DUAL ELEMENTS OF OCRWM TRANSPORTATION PROGRAM

- TECHNICAL DEVELOPMENT OF THE SYSTEM
- DEVELOPMENT OF SUPPORTIVE INSTITUTIONAL ENVIRONMENT
  - FOCUS ON INTERGOVERNMENTAL, INDUSTRY AND THE UTILITIES, AND THE PUBLIC
  - INTERACTIVE COMMUNICATIONS NETWORK
  - ISSUE IDENTIFICATION AND RESOLUTION


TRANSPORTATION SYSTEMS AQUISITION
PHASE I - CASK DEVELOPMENT
,INITIATIVE I FROM-REACTOR CASKS
INITIATIVE 2 FROM-MRS-TO REPOSITORY CASKS (SUBJECT TO CONGRESSIONAL APPROVAL)
INITIATIVE 3 NONSTANDARD SPENT FUEL AND COMPONENTS CASKS
INITIATIVE 4 DEFENSE HIGH-LEVEL WASTE CASKS
PHASE II TRANSPORT OPERATIONS
SERVICE CONTRACTORS
INDEPENDENT OVERVIEW, INSPECTION, AND QUALITY ASSURANCE CONTRACTORS

MAS1734T.022

NWPA SHIPMENT ESTIMATES

- ~5 SHIPMENTS PER DAY
- 500 TO 2000 PER YEAR
- VARIABLE BECAUSE OF
  - CASK DESIGN
  - RAIL AND TRUCK USAGE
  - TYPE OF RAIL SERVICE
  - ACCEPTANCE RATES

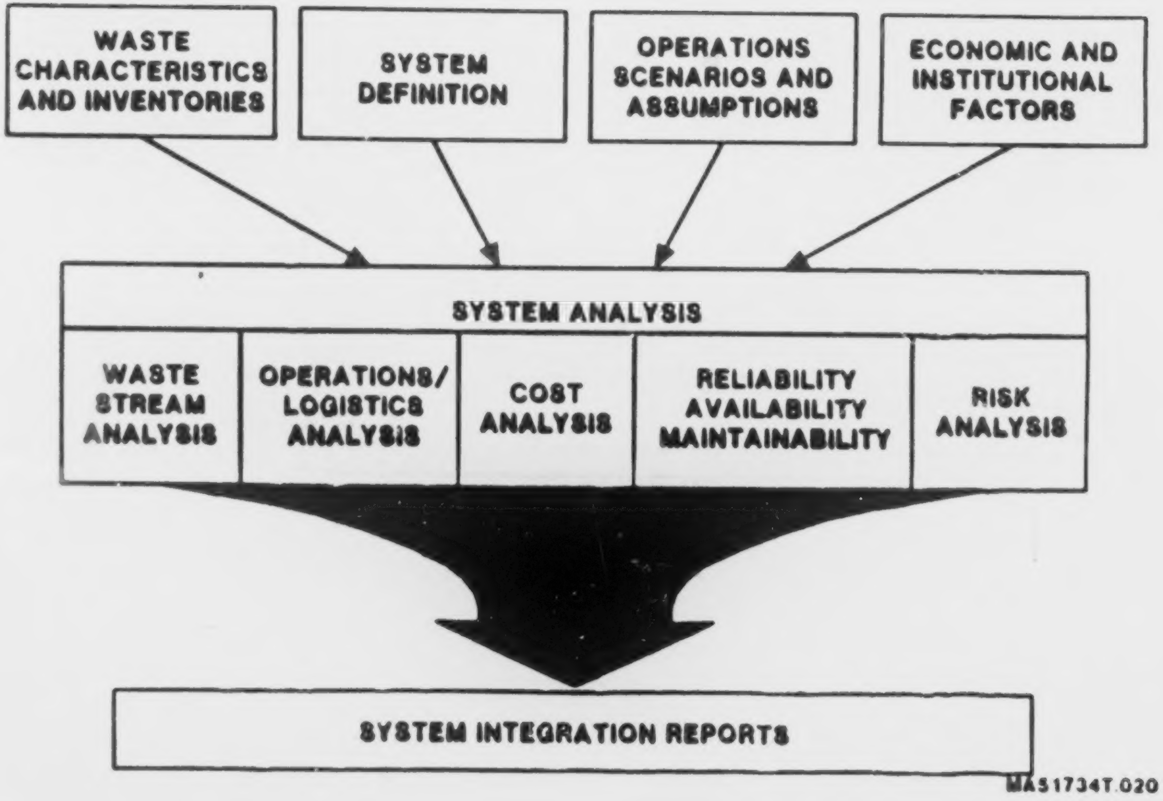
TRANSPORTATION ISSUES

- HIGHWAY ROUTING
- RAIL ROUTING
- PRENOTIFICATION
- PHYSICAL PROTECTION PROCEDURES
- INSPECTION AND ENFORCEMENT / HIGHWAY AND RAIL
- EMERGENCY RESPONSE
- LIABILITY COVERAGE FOR TRANSPORTATION TO NWPA FACILITIES
- CASK DESIGN AND TESTING
- OVERWEIGHT TRUCK SHIPMENTS
- RAIL SERVICE ANALYSIS
- MIXTURE OF TRANSPORTATION MODES
- INFRASTRUCTURE IMPROVEMENTS
- OCRWM TRAINING STANDARDS
- TRANSPORTATION OPERATIONAL PROCEDURES
- STATE, TRIBAL, AND LOCAL REGULATION OF TRANSPORTATION
- TRANSPORTATION OF DEFENSE WASTE

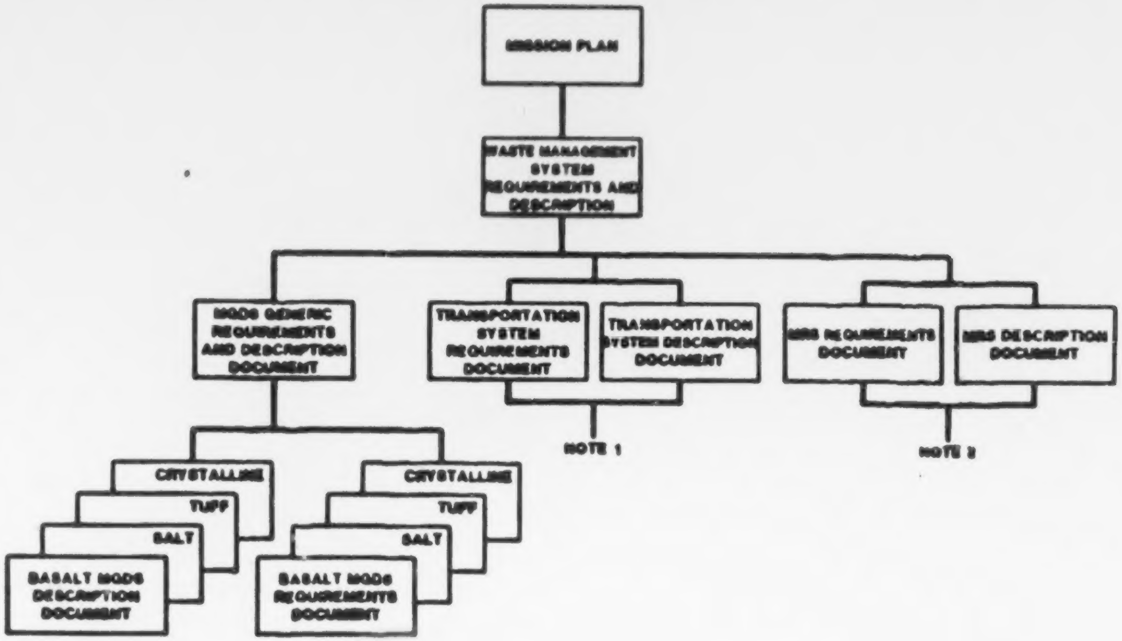
MAS1734T.001

SYSTEMS INTEGRATION

MA51734T.019


WASTE CHARACTERISTICS AND INVENTORIES
SYSTEM DEFINITION
OPERATIONS SCENARIOS AND ASSUMPTIONS
ECONOMIC AND INSTITUTIONAL FACTORS
SYSTEM ANALYSIS
WASTE STREAM ANALYSIS
OPERATIONS/ LOGISTICS ANALYSIS
COST ANALYSIS
RELIABILITY AVAILABILITY MAINTAINABILITY
RISK ANALYSIS
SYSTEM INTEGRATION REPORTS
MA51734T.020

MAJOR TECHNICAL BASELINE DUCOMENTS OF THE PROGRAM


MISSION PLAN
WASTE MANAGEMENT SYSTEM REQUIREMENTS AND DESCRIPTION
MGDS GENERIC REQUIREMENTS AND DESCRIPTION DOCUMENT
TRANSPORTATION SYSTEM REQUIREMENTS DOCUMENT
TRANSPORTATION SYSTEM DESCRIPTION DOCUMENT
MRS REQUIREMENTS DOCUMENT
MRS DESCRIPTION DOCUMENT
NOTE 1
NOTE 2
CRYSTALLINE
TUFF
SALT
BASALT MGDS DESCRIPTION DOCUMENT
CRYSTALLINE
TUFF
SALT
BASALT MGDS REQUIREMENTS DOCUMENT

NOTES
1. DETAIL TO BE DEVELOPED
2. DETAIL TO BE DEVELOPED IF CONGRESSIONAL APPROVAL IS RECEIVED

MA51734T.021

GEOLOGIC REPOSITORY PROGRAM

STEPHEN H. KALE
ASSOCIATE DIRECTOR
OFFICE OF GEOLOGIC REPOSITORIES

JUNE 16, 1987

BRIEFING OUTLINE

1. PROGRAM OBJECTIVE AND MAJOR ACTIVITIES MANDATED BY THE NUCLEAR WASTE POLICY ACT
2. PROGRAM PHASES AND SCHEDULE
3. ORGANIZATION
4. INSTITUTIONAL PROGRAM
5. REGULATORY REQUIREMENTS
6. QUALITY ASSURANCE
7. PROGRAM MANAGEMENT DOCUMENTS
8. MAJOR TECHNICAL ACTIVITIES
9. SECOND REPOSITORY

1. OBJECTIVE

TO PROVIDE FACILITIES FOR THE PERMANENT DISPOSAL OF SPENT FUEL AND HIGH-LEVEL WASTE IN A MANNER THAT PROTECTS THE PUBLIC HEALTH AND SAFETY AND THAT IS ENVIRONMENTALLY ACCEPTABLE

MAJOR ACTIVITIES MANDATED BY THE NUCLEAR WASTE POLICY ACT OF 1982

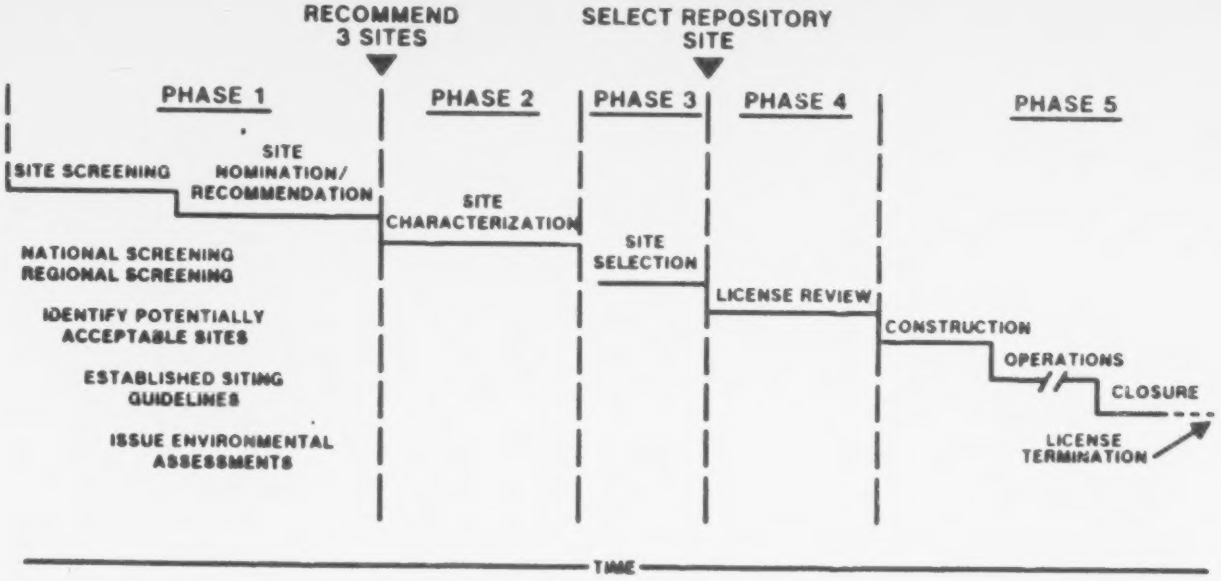
- IDENTIFY POTENTIALLY ACCEPTABLE SITES FOR THE FIRST REPOSITORY
- ESTABLISH SITING GUIDELINES
- PREPARE FINAL ENVIRONMENTAL ASSESSMENTS AND NOMINATE AT LEAST FIVE SITES FOR CHARACTERIZATION
- RECOMMENDED THREE SITES FOR CHARACTERIZATION
- PERFORM SITE CHARACTERIZATION
- SELECT FIRST REPOSITORY SITE
- CONSTRUCT FIRST REPOSITORY
- SELECT SECOND REPOSITORY SITE
- CONSULT AND COOPERATE WITH AFFECTED STATES AND INDIAN TRIBES
- PROVIDE FINANCIAL ASSISTANCE TO AFFECTED STATES AND INDIAN TRIBES

MAS1734T.030

2. PROGRAM PHASES AND SCHEDULE

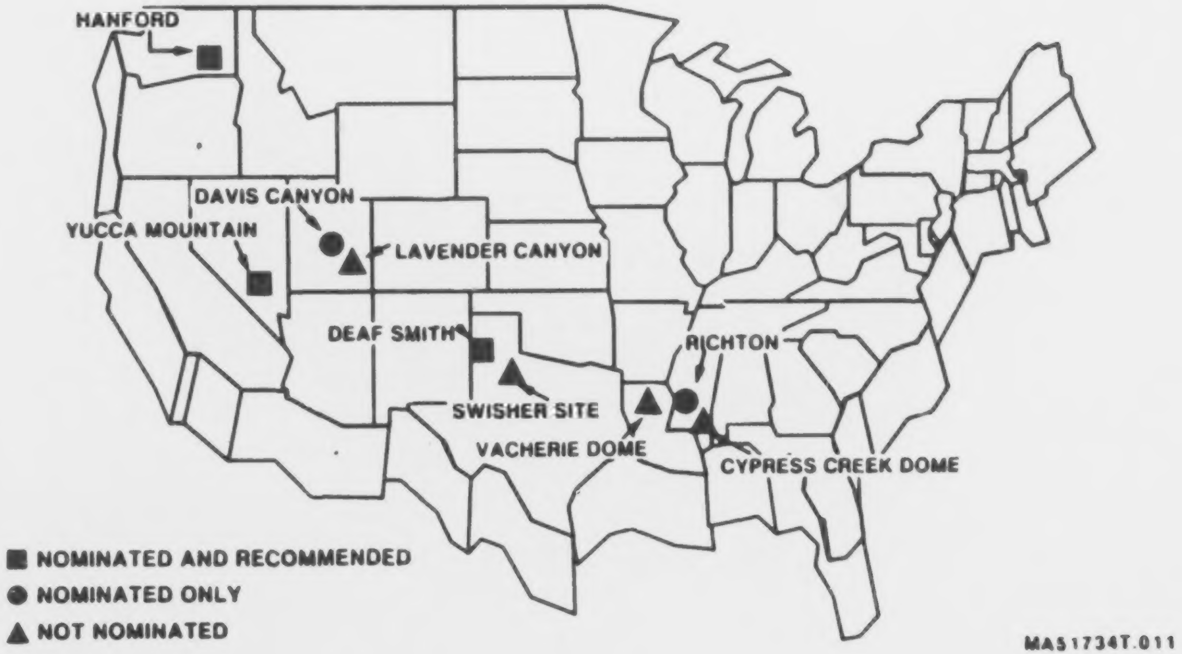
MA51734T.031

MAJOR PHASES OF GEOLOGIC REPOSITORY PROGRAM


RECOMMEND 3 SITES
SELECT REPOSITORY SITE
PHASE 1
PHASE 2
PHASE 3
PHASE 4
PHASE 5
SITE SCREENING
SITE NOMINATION/ RECOMMENDATION
SITE CHARACTERIZATION
SITE SELECTION
LICENSE REVIEW
CONSTRUCTION
OPERATIONS
CLOSURE
LICENSE TERMINATION
NATIONAL SCREENING
REGIONAL SCREENING
IDENTIFY POTENTIALLY ACCEPTABLE SITES
ESTABLISHED SITING GUIDELINES
ISSUE ENVIRONMENTAL ASSESSMENTS
TIME

MA51734T.067

STATUS OF FIRST REPOSITORY SITES


HANFORD
DAVIS CANYON
YUCCA MOUNTAIN
LAVENDER CANYON
DEAF SMITH
RICHTON
SWISHER SITE
VACHERIE DOME
CYPRESS CREEK DOME
■ NOMINATED AND RECOMMENDED
● NOMINATED ONLY
▲ NOT NOMINATED
MA51734T.011

PROJECT IDENTIFICATION

- PROJECT TITLES AND LOCATIONS

1. BASALT WASTE ISOLATION PROJECT	- BWIP	- RICHLAND, WASHINGTON	- BASALT
2. NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS PROJECT	- NNWSI	- LAS VEGAS, NEVADA	- TUFF
3. SALT REPOSITORY PROJECT	- SRP	- COLUMBUS, OHIO AND DEAF SMITH COUNTY, TEXAS	- SALT

FIRST REPOSITORY PROGRAM SCHEDULE

	NNWSI TUFF	BWIP BASALT	SRP SALT
ISSUE SITE CHARACTERIZATION PLAN	THIRD QUARTER 1987	FOURTH QUARTER 1987	FIRST QUARTER 1988
START EXPLORATORY SHAFT CONSTRUCTION	FOURTH QUARTER 1988	SECOND QUARTER 1989	FOURTH QUARTER 1989
START IN-SITU TESTING	SECOND QUARTER 1990	FOURTH QUARTER 1991	FOURTH QUARTER 1991

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FIRST REPOSITORY PROGRAM SCHEDULE
(CONT'D)

DRAFT ENVIRONMENTAL IMPACT STATEMENT	FOURTH QUARTER 1993
FINAL ENVIRONMENTAL IMPACT STATEMENT	FOURTH QUARTER 1994
SUBMITTAL OF SITE-SELECTION REPORT TO THE PRESIDENT	FOURTH QUARTER 1994
SUBMITTAL OF LICENSE APPLICATION TO THE NRC	FIRST QUARTER 1995
RECEIPT OF CONSTRUCTION AUTHORIZATION FROM THE NRC	FIRST QUARTER 1998
START OF CONSTRUCTION	FIRST QUARTER 1998
START OF PHASE I OPERATIONS	FIRST QUARTER 2003
START OF PHASE II OPERATIONS	SECOND QUARTER 2006

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3. ORGANIZATION

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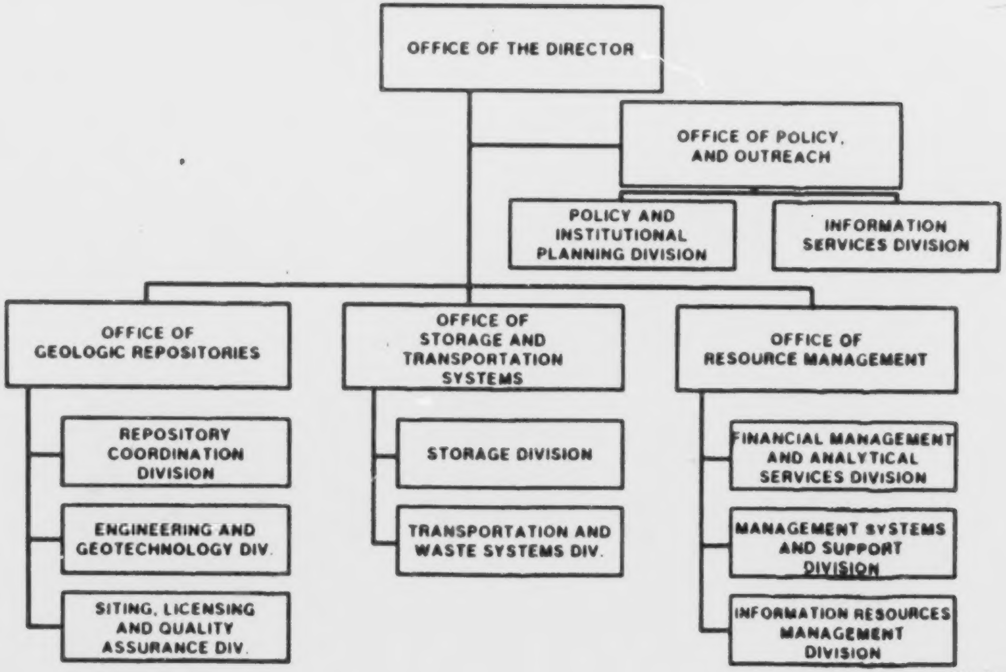
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT


OFFICE OF THE DIRECTOR
OFFICE OF POLICY, AND OUTREACH
POLICY AND INSTITUTIONAL PLANNING DIVISION
INFORMATION SERVICES DIVISION
OFFICE OF GEOLOGIC REPOSITORIES
REPOSITORY COORDINATION DIVISION
ENGINEERING AND GEOTECHNOLOGY DIV.
SITING, LICENSING AND QUALITY ASSURANCE DIV.
OFFICE OF STORAGE AND TRANSPORTATION SYSTEMS
STORAGE DIVISION
TRANSPORTATION AND WASTE SYSTEMS DIV.
OFFICE OF RESOURCE MANAGEMENT
FINANCIAL MANAGEMENT AND ANALYTICAL SERVICES DIVISION
MANAGEMENT SYSTEMS AND SUPPORT DIVISION
INFORMATION RESOURCES MANAGEMENT DIVISION

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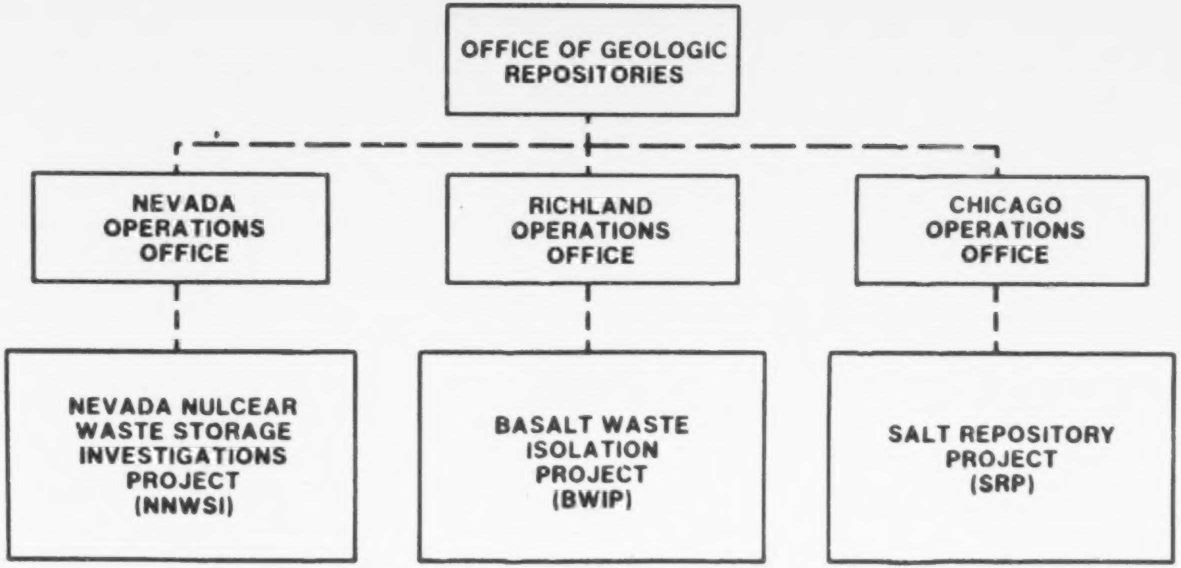
PROGRAMMATIC RELATIONSHIPS



OFFICE OF GEOLOGIC REPOSITORIES

NEVADA OPERATIONS OFFICE

RICHLAND OPERATIONS OFFICE

CHICAGO OPERATIONS OFFICE

NEVADA NULCEAR WASTE STORAGE INVESTIGATIONS PROJECT (NNWSI)

BASALT WASTE ISOLATION PROJECT (BWIP)

SALT REPOSITORY PROJECT (SRP)

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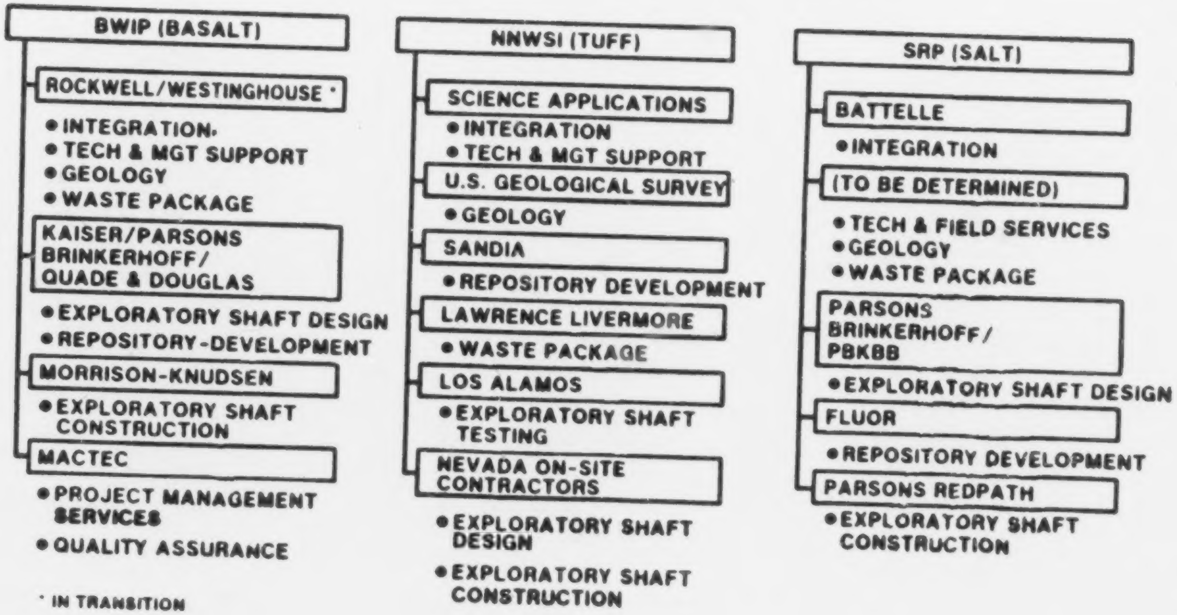
FIELD PROJECT OFFICES AND PROJECT CONTRACTORS



BWIP (BASALT)

ROCKWELL/WESTINGHOUSE *
- INTEGRATION.
- TECH & MGT SUPPORT
- GEOLOGY
- WASTE PACKAGE

KAISER/PARSONS BRINKERHOFF/ QUADE & DOUGLAS
- EXPLORATORY SHAFT DESIGN
- REPOSITORY-DEVELOPMENT

MORRISON-KNUDSEN
- EXPLORATORY SHAFT CONSTRUCTION

MACTEC
- PROJECT MANAGEMENT SERVICES
- QUALITY ASSURANCE

* IN TRANSITION

NNWSI (TUFF)

SCIENCE APPLICATIONS
- INTEGRATION
- TECH & MGT SUPPORT

U.S. GEOLOGICAL SURVEY
- GEOLOGY

SANDIA
- REPOSITORY DEVELOPMENT

LAWRENCE LIVERMORE
- WASTE PACKAGE

LOS ALAMOS
- EXPLORATORY SHAFT TESTING

NEVADA ON-SITE CONTRACTORS
- EXPLORATORY SHAFT DESIGN
- EXPLORATORY SHAFT CONSTRUCTION

SRP (SALT)

BATTELLE
- INTEGRATION

(TO BE DETERMINED)
- TECH & FIELD SERVICES
- GEOLOGY
- WASTE PACKAGE

PARSONS BRINKERHOFF/ PBKBB
- EXPLORATORY SHAFT DESIGN

FLUOR
- REPOSITORY DEVELOPMENT

PARSONS REDPATH
- EXPLORATORY SHAFT CONSTRUCTION

MA51734T.073

4. INSTITUTIONAL PROGRAM

- NUCLEAR WASTE POLICY ACT ESTABLISHES REQUIREMENTS FOR INSTITUTIONAL INTERACTIONS
- STATE, INDIAN TRIBE, AND PUBLIC PARTICIPATION IN THE PLANNING AND DEVELOPMENT OF REPOSITORIES IS ESSENTIAL TO PROMOTE PUBLIC CONFIDENCE IN THE SAFETY AND DISPOSAL OF HIGH-LEVEL WASTE AND SPENT FUEL

MA51734T.036

INSTITUTIONAL ACTIVITIES

- STATE/INDIAN TRIBE INTERACTIONS
  - DESK OFFICER SYSTEM
  - COORDINATING GROUP MEETINGS
  - SENIOR POLICY MEETINGS WITH STATES AND INDIAN TRIBES
  - FULL PARTICIPATION AT NRC MEETINGS
- SECTION 117 (C) CONSULTATION AND COOPERATION NEGOTIATIONS UNDERWAY
- EXTENSIVE INTERACTIONS OCCURRING WITHOUT FORMAL AGREEMENTS
- FACILITY SPECIFIC OUTREACH AND PARTICIPATION PLANS

MA51734T.037

FINANCIAL ASSISTANCE

- PROVIDE FOR OVERSIGHT IF PROGRAM ACTIVITIES BY STATES AND INDIAN TRIBES THROUGH A COMPREHENSIVE PROGRAM OF GRANTS
- $58 MILLION GRANTED TO DATE
- PROVIDE REVENUES TO STATES AND UNITS OF GENERAL LOCAL GOVERNMENT THROUGH PAYMENTS EQUIVALENT TO TAXES

MA51734T.038

5. REGULATORY REQUIREMENTS FOR THE DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTE

- ENVIRONMENTAL STANDARDS FOR THE MANAGEMENT AND DISPOSAL OF SPENT NUCLEAR FUEL, HIGH-LEVEL AND AND TRANSURANIC WASTES (EPA STANDARD, 40 CFR PART 191)
- DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTES IN GEOLOGIC REPOSITORIES (NRC RULE, 10 CFR PART 60)
- GENERAL GUIDELINES FOR THE RECOMMENDATION OF SITES FOR THE NUCLEAR WASTE REPOSITORIES: FINAL SITING GUIDELINES (DOE GUIDELINES, 10 CFR PART 960)

OVERALL PERFORMANCE STANDARD EPA GENERAL ENVIRONMENTAL STANDARD - 40 CFR 191

DURING OPERATION

- 25 MREM/YR TO MAXIMUM INDIVIDUAL

POST CLOSURE

- LIMITS ON TOTAL QUANTITY OF RADIOACTIVE MATERIAL RELEASED TO ACCESSIBLE ENVIRONMENT FOR 10,000 YEARS
- 25 MREM/YR TO MAXIMUM INDIVIDUAL FOR 1,000 YEARS
- LIMITS RADIONUCLIDE CONCENTRATIONS IN GROUNDWATER FOR 1,000 YEARS

SUMMARY OF NRC PERFORMANCE CRITERIA FOR CONTAINMENT/ISOLATION - 10 CFR 60

- RELEASE TO THE ACCESSIBLE ENVIRONMENT SHALL BE LESS THAN THE LIMITS SPECIFIED BY EPA
- WASTE PACKAGE TO PROVIDE SUBSTANTIALLY COMPLETE CONTAINMENT OF RADIONUCLIDE FOR 300-1000 YEARS
- ENGINEERED SYSTEM TO MEET ANNUAL RELEASE RATE LIMIT OF 10 PPM OF RADIONUCLIDE INVENTORY AT 1000 YEARS
- 1000 YR. GROUNDWATER TRAVEL TIME TO ACCESSIBLE ENVIRONMENT

MA51734T.041

GENERAL SITING GUIDELINES - 10 CFR 960

- GUIDELINES TO CONSIDER FACTORS PERTAINING TO:
  - NATURAL RESOURCES
  - HYDROLOGY
  - GEOPHYSICS
  - SEISMIC ACTIVITY
  - DEFENSE ACTIVITIES
  - WATER SUPPLIES
  - POPULATIONS
  - WATER USER RIGHTS
  - PROXIMITY TO NATIONAL PARKS, ETC.
- GUIDELINES TO CONSIDER PROXIMITY TO SITES FOR STORAGE OR GENERATION OF SPENT FUEL WASTES
- GUIDELINES TO CONSIDER TRANSPORTATION AND SAFETY FACTORS IN MOVING WASTE TO REPOSITORY
- GUIDELINES TO SPECIFY POPULATION FACTORS TO DISQUALIFY SITE
- GUIDELINES TO REQUIRE SECRETARY TO CONSIDER
  - COST IMPACT OF TRANSPORTING WASTE
  - ADVANTAGE OF REGIONAL DISTRIBUTION IN SITING
  - VARIOUS GEOLOGIC MEDIA

MA51734T.042

MAJOR REGULATORY ACTIVITIES

- CONDUCT INTENSIFIED INTERACTIONS WITH THE NUCLEAR REGULATORY COMMISSION
- CONDUCT ENVIRONMENTAL AND SOCIOECONOMIC MONITORING DURING SITE CHARACTERIZATION AND MITIGATE SIGNIFICANT ADVERSE IMPACTS
- CONDUCT QUALITY ASSURANCE PROGRAMS THAT MEET LICENSING REQUIREMENTS
- MANAGE INFORMATION NEEDED FOR LICENSING
- SCOPE AND PREPARE ENVIRONMENTAL IMPACT STATEMENT
- PREPARE LICENSE APPLICATION

QUALITY ASSURANCE POLICY

- ACHIEVE AND ASSURE MANAGEMENT AND TECHNICAL EXCELLENCE IN ALL ASPECTS OF THE PROGRAM
- PROTECT PUBLIC HEALTH AND SAFETY AND THE ENVIRONMENT
- COMPLY WITH LEGISLATIVE AND REGULATORY REQUIREMENTS
- DEMONSTRATE ADEQUATE QUALITY IN PERSONNEL, ACTIVITIES, AND DATA

MA51734T.044

OGR QA PROGRAM
GOVERNING DOCUMENTS

NRC

- 10 CFR 60, SUBPART G
- 10CFR 50, APPENDIX B
- NRC REVIEW PLAN - QUALITY ASSURANCE PROGRAMS FOR SITE CHARACTERIZATION OF HIGH LEVEL NUCLEAR WASTE REPOSITORIES

NATIONAL CONSENSUS STANDARD

- ANSI/ASME NQA-1, QUALITY ASSURANCE REQUIREMENTS FOR NUCLEAR FACILITIES

10 CFR 60, "DISPOSAL OF HIGH LEVEL RADIOACTIVE WASTES IN GEOLOGIC REPOSITORIES"

REQUIRES DOE TO IMPLEMENT A QUALITY ASSURANCE PROGRAM BASED ON THE CRITERIA OF APPENDIX B OF 10 CFR PART 50, "QUALITY ASSURANCE CRITERIA FOR NUCLEAR POWER PLANTS" - AS APPLICABLE

APPENDIX B TO 10 CFR PART 50

ESTABLISHES QUALITY ASSURANCE (QA) REQUIREMENTS FOR THE DISIGN, CONSTRUCTION, AND OPERATION OF THOSE STRUCTURES, SYSTEMS, AND COMPONENTS OF NUCLEAR POWER PLANTS AND FUEL REPROCESSING PLANTS ESSENTIAL TO THE PREVENTION OR MITIGATION OF THE CONSEQUENCES OF POSTULATED ACCIDENTS THAT COULD CAUSE UNDUE RISK TO THE HEALTH AND SAFETY OF THE PUBLIC

NRC REVIEW PLAN

DEFINES CRITERIA & METHODS NRC USES TO REVIEW DOE QA PROGRAM FOR SITE CHARACTERIZATION ACTIVITIES DURING PRE-LICENSING PHASE

10 CFR 60, PARAGRAPH 60.151

ACTIVITIES COVERED BY THE QA PROGRAM INCLUDE:

- SITE CHARACTERIZATION
- FACILITY AND EQUIPMENT CONSTRUCTION
- FACILITY OPERATION
- PERFORMANCE CONFIRMATION
- PERMANENT CLOSURE
- DECONTAMINATION AND DISMANTLING OF SURFACE FACILITIES

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PROGRAM MANAGEMENT DOCUMENTS

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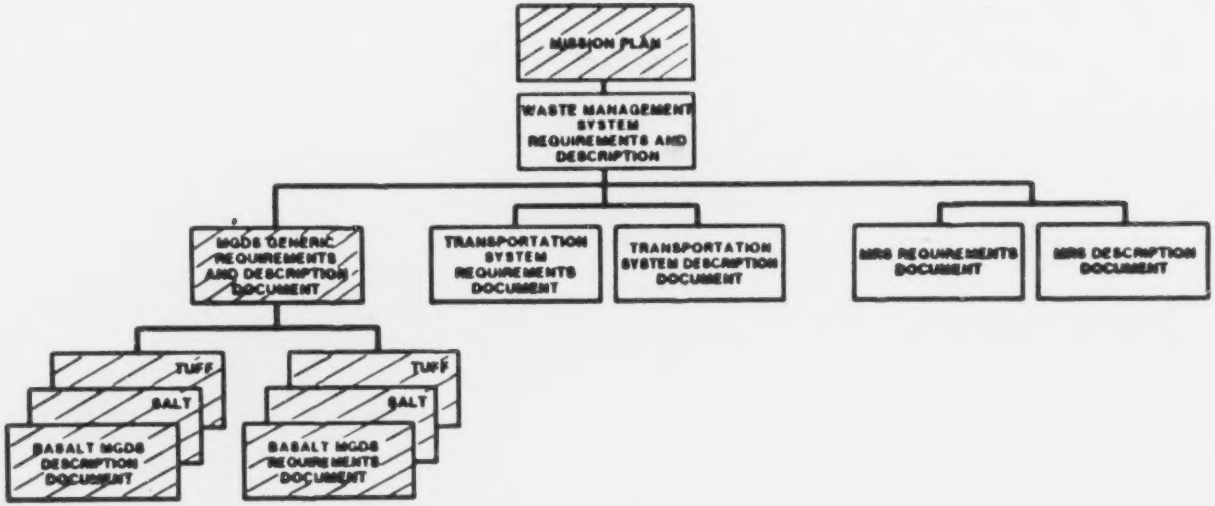
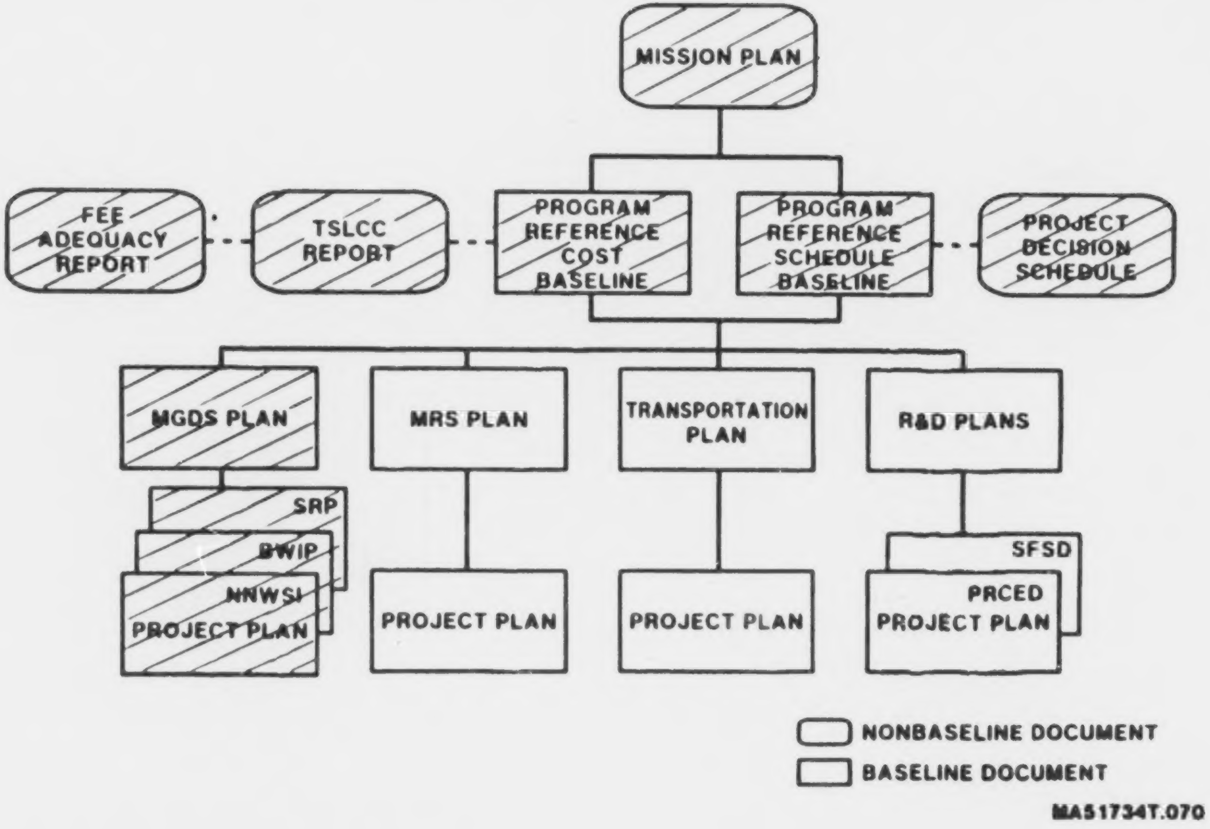
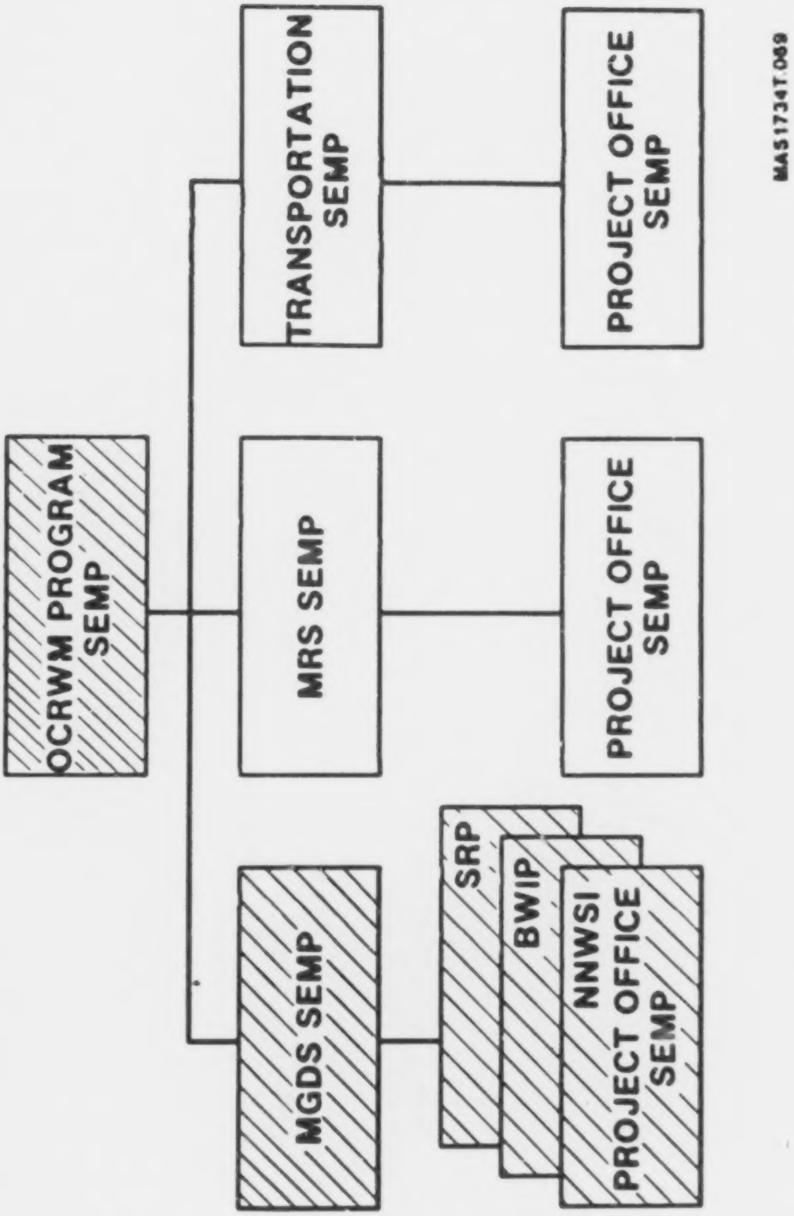

MISSION PLAN
WASTE MANAGEMENT SYSTEM REQUIREMENTS AND DESCRIPTION
MGDS GENERIC REQUIREMENTS AND DESCRIPTION DOCUMENT
TRANSPORTATION SYSTEM REQUIREMENTS DOCUMENT
TRANSPORTATION SYSTEM DESCRIPTION DOCUMENT
MRS REQUIREMENTS DOCUMENT
MRS DESCRIPTION DOCUMENT
TUFF
SALT
BASALT MGDS DESCRIPTION DOCUMENT
TUFF
SALT
BASALT MGDS REQUIREMENTS DOCUMENT

MA51734T.088


MISSION PLAN
FEE ADEQUACY REPORT
TSLCC REPORT
PROGRAM REFERENCE COST BASELINE
PROGRAM REFERENCE SCHEDULE BASELINE
PROJECT DECISION SCHEDULE
MGDS PLAN
MRS PLAN
TRANSPORTATION PLAN
R&D PLANS
SRP
BWIP
NNWSI
PROJECT PLAN
PROJECT PLAN
PROJECT PLAN
SFSD
PRCED
PROJECT PLAN
NONBASELINE DOCUMENT
BASELINE DOCUMENT
MA51734T.070


OCRWM PROGRAM SEMP
MGDS SEMP
MRS SEMP
TRANSPORTATION SEMP
SRP
BWIP
NNWSI PROJECT OFFICE SEMP
PROJECT OFFICE SEMP
PROJECT OFFICE SEMP
MAS17334T.069

MAJOR TECHNICAL ACTIVITIES

- SITE CHARACTERIZATION PLANS
- EXPLORATORY SHAFT DESIGN AND CONSTRUCTION
- SITE DATA COLLECTION
- REPOSITORY DESIGN
- WASTE PACKAGE DEVELOPMENT

PURPOSE OF THE SITE CHARACTERIZATION PLAN

- TO IDENTIFY ISSUES TO BE RESOLVED DURING LICENSING
- TO IDENTIFY INFORMATION NEEDED TO RESOLVE ISSUES
- TO PRESENT PLANS FOR ACQUIRING AND ANALYZING INFORMATION

SIGNIFICANCE OF SCP SITE CHARACTERIZATION PLAN (SCP)

- SCP WILL GUIDE THE DEPARTMENT'S SITE CHARACTERIZATION PROGRAM UNTIL LICENSE APPLICATION IS SUBMITTED
- SCP AND PERIODIC PROGRESS REPORTS WILL HAVE CRUCIAL ROLE OVER NEXT 6-7 YEARS
    - IN NRC INTERACTIONS
    - AS VEHICLES FOR PRESENTING INFORMATION ON SITE CHARACTERIZATION PROGRAM TO STATES, PUBLIC, CONGRESS, UTILITIES

STRUCTURE OF SITE CHARACTERIZATION PLAN

- PART A: DESCRIPTION OF SITE, WASTE PACKAGE, AND REPOSITORY DESIGN

  7 INDIVIDUAL DESCRIPTIVE CHAPTERS

  - PRESENT INFORMATION ALREADY COLLECTED
  - PROVIDE BASIS FOR IDENTIFYING ISSUES REMAINING TO BE RESOLVED AND TESTS TO BE PERFORMED

- PART B: SITE CHARACTERIZATION PROGRAM

  CHAPTER 8

  - PRESENTS RATIONALE FOR CONDUCTING SITE CHARACTERIZATION
  - IDENTIFIES ISSUES TO BE RESOLVED DURING SITE CHARACTERIZATION
  - IDENTIFIES INFORMATION NEEDED TO RESOLVE ISSUES
  - PRESENTS PLANS FOR ACQUIRING AND ANALYZING INFORMATION

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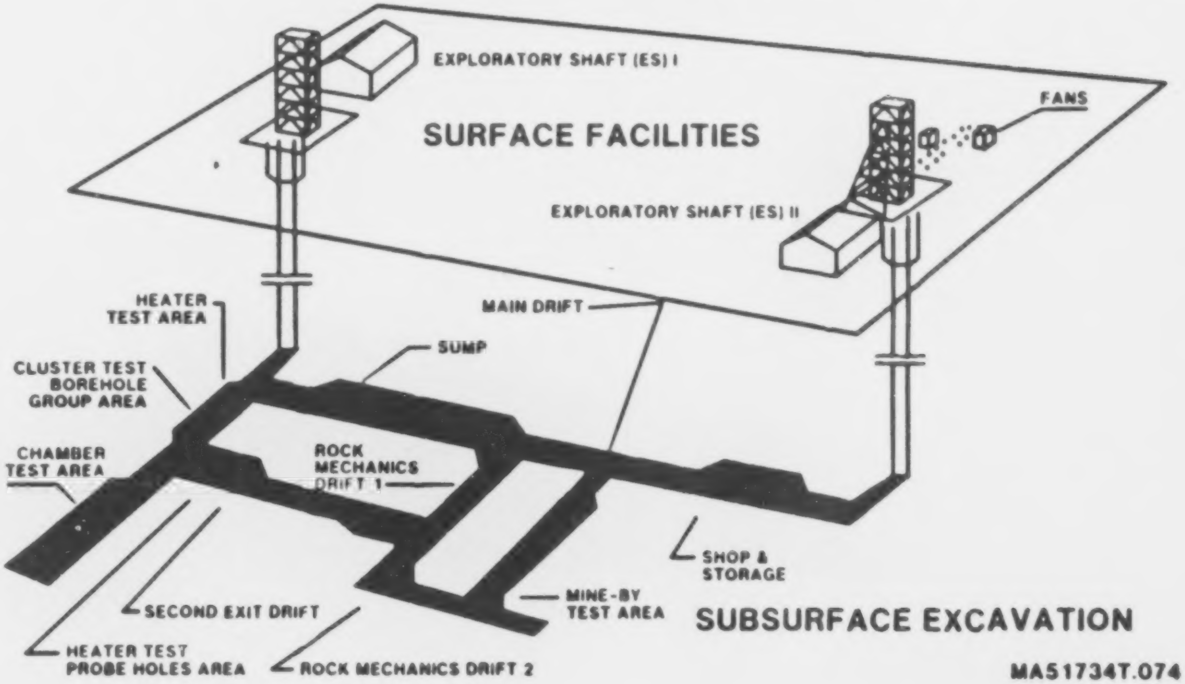
EXPLORATORY SHAFT
FACILITY ISOMETRIC


EXPLORATORY SHAFT (ES) I
SURFACE FACILITIES
FANS
EXPLORATORY SHAFT (ES) II
HEATER TEST AREA
MAIN DRIFT
SUMP
CLUSTER TEST BOREHOLE GROUP AREA
CHAMBER TEST AREA
ROCK MECHANICS DRIFT 1
SHOP & STORAGE
MINE-BY TEST AREA
SECOND EXIT DRIFT
HEATER TEST PROBE HOLES AREA
ROCK MECHANICS DRIFT 2
SUBSURFACE EXCAVATION

MA51734T.074

EXPLORATORY SHAFT

FEATURE	BASALT	SALT	TUFF
● FIRST SHAFT	6' FINISHED	12' FINISHED	12' FINISHED
● SECOND SHAFT	10' FINISHED	12' FINISHED	12' FINISHED
● SHAFT CONSTRUCTION METHOD	BLIND HOLE BORING	CONVENTIONAL	CONVENTIONAL
● SHAFT DEPTH	3400'	2755'	1480'
● TEST HORIZON DEPTH	3160' (COHASSETT)	2555' (LOWER SAN ANDREAS)	1200' (TOPAPAH SPRINGS)
● UNDERGROUND DRIFTS	3400'	5400'	9600'

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EXPLORATORY SHAFT FACILITY

STATUS

- PRELIMINARY DESIGN COMPLETED FOR BASALT, TUFF, AND SALT
- FINAL DESIGN PLANNING UNDERWAY FOR TUFF AND BASALT; SALT AT 30% FINAL DESIGN LEVEL
- SITE SELECTED AND MAJOR EQUIPMENT ON-SITE AT TUFF AND BASALT
- SITE PREPARATION COMPLETED AT BASALT
- ROAD AND UTILITIES COMPLETED TO NTS BOUNDARY AT TUFF

MA51734T.054

REQUIRED ACTIVITIES PRIOR TO SHAFT SINKING

- PRESIDENTIAL RECOMMENDATION
- ISSUE SITE CHARACTERIZATION PLAN
- HOLD PUBLIC HEARINGS
- RECEIVE COMMENTS OF AREA RESIDENTS, STATES AND INDIAN TRIBES

MA51734T.055

SITE DATA COLLECTION

SITE BORINGS, LABORATORY TESTING, ANALYSIS, AND MODELLING TO CHARACTERIZE:

- GEOLOGY
  - STRATIGRAPHY - THICKNESS VARIABILITY EXTENT OF ROCK LAYERS TECTONICS AND SEISMOLOGY - FOLDING, FAULTING, EARTHQUAKE POTENTIAL
- GEOENGINEERING
  - ROCK PROPERTIES - STRENGTH, IN-SITU STRESS
- HYDROLOGY
  - WATER QUALITY, QUANTITY, LEVELS, FLOW DIRECTION, TRAVEL TIME, CLIMATIC AND FLOODING CONDITIONS AND IMPACT
- GEOCHEMISTRY
  - WATER-WASTE-ROCK INTERACTIONS
  - RADIONUCLIDE TRANSPORT IN THE WATER-ROCK SYSTEM
- ENVIRONMENTAL AND SOCIOECONOMIC
  - ENVIRONMENTAL AND SOCIOECONOMIC MONITORING
  - SOCIAL AND ECONOMIC PROFILES
  - ENVIRONMENTAL DATA COLLECTION

MA51734T.057

SITE INFORMATION ACQUISITION METHODS

- SURFACE BASED TESTING
  - BOREHOLES
  - TRENCHING
  - ENVIRONMENTAL
- UNDERGROUND TESTING (EXPLORATORY SHAFT)
  - CONSTRUCTION TESTING
    - SHAFT MAPPING
    - GROUND-WATER INFLOW
    - GEOLOGIC MAPPING
    - GROUT/SEAL INTEGRITY
    - ROOM DEFORMATION
  - IN-SITU TESTING
    - THERMOMECHANICAL TESTS
    - GEOPHYSCIAL TESTS
    - SEAL-PERFORMANCE TETS

REPOSITORY
KEY FUNCTIONAL REQUIREMENTS

- TOTAL DESIGN CAPACITY - 70,000 MTU
- SPENT FUEL RECEIPTS - 62,000 MTU: HLW RECEIPTS - 8,000 MTU
- PHASE I RECEIPT RATE: SPENT FUEL - 400 MTU/YEAR
- PHASE II RECEIPT RATE: SPENT FUEL - 3,000 MTU/YEAR
  HLW - 400 MTU/YEAR
- ALL FUEL WILL BE PACKED INTACT
- PHASE II: 10% WILL BE PACKAGED INTACT
  90% WILL BE HANDLED AS CONSOLIDATED FUEL
- SPENT FUEL RECEIPTS WILL BE 60% PWR AND 40% BWR
- CAPABILITY TO BEGIN WASTE RETRIEVAL WILL BE MAINTAINED FOR UP TO 50 YEARS FORM THE START OF WASTE EMPLACEMENT

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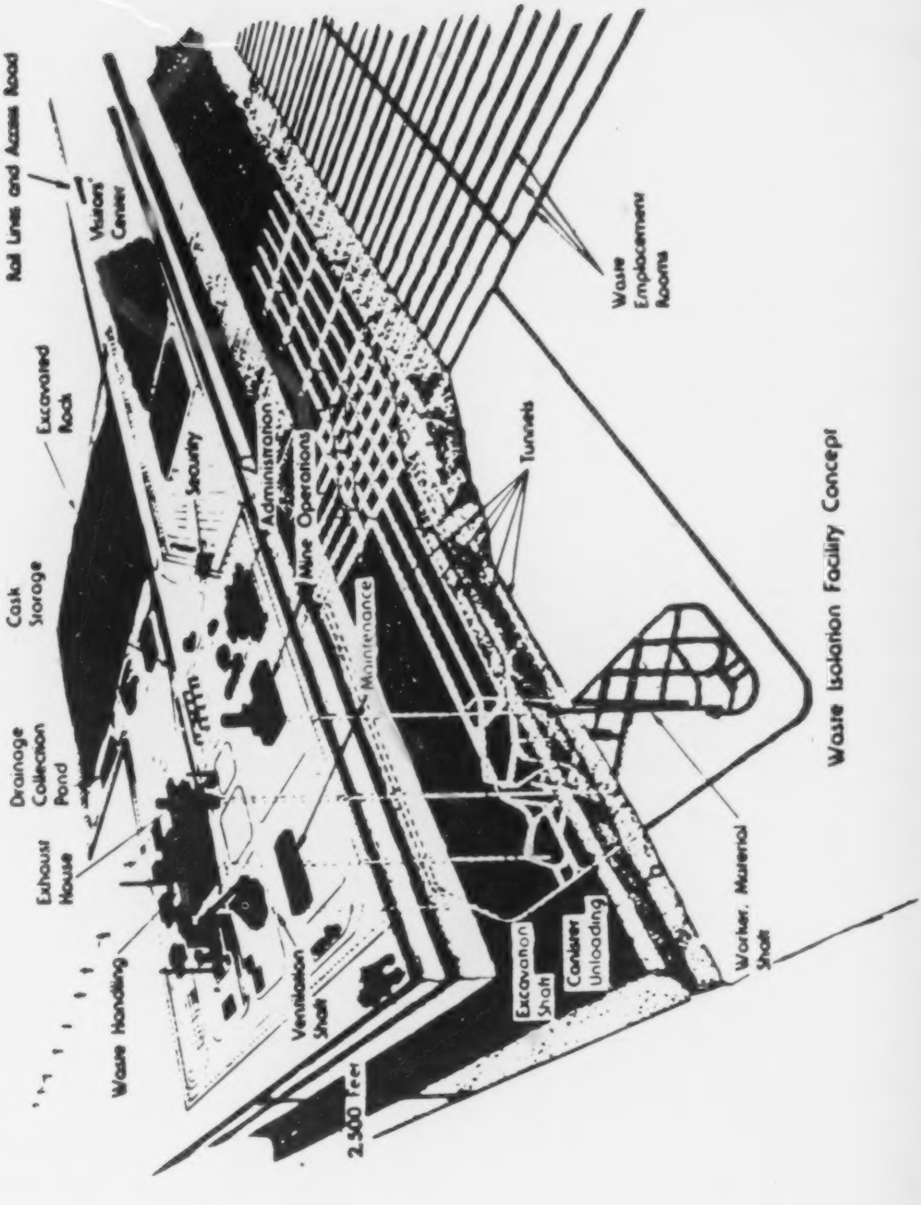
Rail Lines and Access Road
Visitors' Center
Excavated Rock
Cask Storage
Security
Administration
Drainage Collection Pond
Exhaust House
Waste Handling
Ventilation Shaft
Mine Operations
Maintenance
2,500 Feet
Excavation Shaft
Container Unloading
Worker, Material Shaft
Tunnels
Waste Emplacement Rooms

Waste Isolation Facility Concept

REPOSITORY

STATUS

- TWO-PHASE REPOSITORY FACILITY DESIGN STUDIES COMPLETED FOR MISSION PLAN
- MRS/REPOSITORY DESIGN INTEGRATION STUDY COMPLETED
- SCP CONCEPTUAL DESIGNS COMPLETED; FINAL REPORTS, NOW IN PREPARATION, WILL REPRESENT CURRENT STATE OF DESIGN INFORMATION
- RETRIEVABILITY POSITION BASELINED
- SITE-SPECIFIC DATA ON ROCK MASS PROPERTIES BEING INVESTIGATED
- PRELIMINARY SEALING AND ROCK MECHANICS TEST PLANS DEVELOPED
- BUREAU OF MINE TECHNICAL SUPPORT PROTOCOL IN PLACE; MOU WITH MSHA FOR TECHNICAL SUPPORT IN PLACE

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WASTE PACKAGE

KEY FUNCTIONAL REQUIREMENTS

- PROVIDE FOR SAFE HANDLING OF THE WASTE
- PRESERVE ABILITY TO SAFELY RETRIEVE THE WASTE UNTIL REPOSITORY CLOSURE
- PROVIDE ESSENTIALLY COMPLETE CONTAINMENT OF RADIONUCLIDES FOR 300 - 1,000 YEARS
- CONTRIBUTE TO LIMITING RELEASE OF RADIONUCLIDES FORM THE ENGINEERED BARRIER SYSTEM TO THE HOST ROCK OVER THE LONG TERM

MA51734T.060

WASTE PACKAGE

STATUS

- WASTE PACKAGE CONCEPTUAL DESIGNS COMPLETED FOR SCP; FINAL REPORTS, NOW IN PREPARATION, WILL REPRESENT CURRENT STATE OF DESIGN INFORMATION
- WASTE PACKAGE ADVANCED CONCEPTUAL DESIGN PLANNING UNDERWAY
- WASTE ACCEPTANCE PRELIMINARY SPECIFICATIONS (WAPS) FOR DEFENSE WASTE PROCESSING FACILITY AND WEST VALLEY DEMONSTRATION PROJECT ISSUED
- REFERENCE AND ALTERNATIVE BARRIER MATERIALS SELECTED FOR TESTING
- FEASIBILITY EVALUATION OF COPPER-BASE MATERIALS COMPLETED
- TESTING OF WASTE FORMS AND BARRIER MATERIALS UNDER REPOSITORY CONDITIONS UNDERWAY
- INITIAL WASTE PACKAGE CORROSION AND RADIONUCLIDE RELEASE MODELS DEVELOPMENT UNDERWAY

MA51734T.061

WASTE PACKAGE
CURRENT DESIGNS

BASALT

- EMPLACEMENT MODE - HORIZONTAL
- REFERENCE CONTAINER MATERIAL - CARBON STEEL (CHROME-MOLY STEEL, CUPRONICKEL)*
- PACKING MATERIAL - 75% BASALT, 25% BENTONITE CLAY

SALT

- EMPLACEMENT MODE - VERTICAL (HORIZONTAL)
- REFERENCE CONTAINER MATERIAL - CARBON STEEL
- PACKING MATERIAL - CRUSHED SALT

TUFF

- EMPLACEMENT MODE - VERTICAL (HORIZONTAL)
- REFERENCE CONTAINER MATERIAL - STAINLESS STEEL (INCOLOY, COPPER-BASE)
- PACKING MATERIAL NONE (CRUSHED TUFF FOR SPENT FUEL)

*() DESIGNATES ALTERNATIVES

MA51734T.062

9. SECOND REPOSITORY

- IF CONGRESS TAKES ACTION TO AFFIRM THE PROGRAM IN THE MISSION PLAN AMENDMENT, A REPOSITORY TECHNOLOGY DEVELOPMENT PROGRAM WILL CONTINUE LEADING TO INITIATION OF SITE-SPECIFIC WORK IN THE MID-TO-LATE 1990's
- IF CONGRESS DOES NOT TAKE ACTION TO AFFIRM THE PROGRAM IN THE MISSION PLAN AMENDMENT, SITE-SPECIFIC WORK WOULD BEGIN FOLLOWING ISSUANCE OF THE FINAL AREA RECOMMENDATION REPORT

PURPOSE OF
SECOND REPOSITORY TECHNOLOGY DEVELOPMENT

- DEVELOP AN ANALYTICAL APPROACH TO EVALUATE CONCEPTUAL GEOLOGIC SETTINGS ON PERFORMANCE PARAMETERS WHICH WILL RESULT IN A HIGH LEVEL OF CONFIDENCE SO THAT FEWER AREAS OF SMALLER SIZE CAN BE SELECTED EARLY IN THE SITING PROCESS

MA51734T.064

SECOND REPOSITORY TECHNOLOGY DEVELOPMENT

DESCRIPTION

- MAJOR EMPHASIS ON GEOSCIENCE CHARACTERIZATION AND PERFORMANCE
- SUPPORTED BY CONSIDERATION OF ENGINEERING PARAMETERS TO EXTENT NECESSARY TO IDENTIFY CONCEPTUAL GEOLOGICAL SETTINGS
- BUILT UPON EXPERIENCE GAINED FROM THE FIRST REPOSITORY PROGRAM AND THROUGH INTERNATIONAL EFFORTS
- REGULATORY BASED (I.E. 10CFR960, 10CFR60, 40CFR191)
- INTEGRATES GEOSCIENCE PERFORMANCE, ENGINEERING COMPATIBILITY, WITH REGULATORY REQUIREMENTS TO SELECT PREFERRED CONCEPTUAL GEOLOGIC SETTINGS

MA51734T.065

SECOND REPOSITORY PROGRAM SCHEDULE

	PROPOSED PROGRAM	ALTERNATIVE PROGRAM
BEGIN NATIONAL SURVEY	1995	COMPLETED
COMPLETE NATIONAL SURVEY	1997	COMPLETED
ISSUE DRAFT AREA RECOMMENDATION REPORT	2000	COMPLETED
ISSUE FINAL AREA RECOMMENDATION REPORT	2002	1989
NOMINATE AND RECOMMEND SITES FOR CHARACTERIZATION	2007	1994
PRESIDENT RECOMMENDS SITE TO CONGRESS	2015	2002
NRC ISSUES CONSTRUCTION AUTHORIZATION	2018	2005
BEGIN OPERATION	2023	2010

MA51734T.066

DRAFT
STATEMENT OF WORK

DOE - OCRWM
SYSTEMS ENGINEERING DEVELOPMENT & MANAGEMENT (SEDM) CONTRACTOR

MARK W. FREI

CHIEF, ENGINEERING BRANCH

OFFICE OF GEOLOGIC
REPOSITORIES

JUNE 16, 1987

MA51734T.093

DRAFT STATEMENT OF WORK

CONTENTS OVERVIEW

I. INTRODUCTION
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I. INTRODUCTION

A. PROGRAM SUMMARY
B. WORKSCOPE SUMMARY
C. STATEMENT OF WORK ORGANIZATION

WORKSCOPE SUMMARY

SEDM CONTRACTOR RESPONSIBILITIES INCLUDE

- OVERALL DESIGN AND ANALYSIS OF THE NUCLEAR WASTE MANAGEMENT SYSTEM
  - REPOSITORIES
  - TRANSPORTATION
  - MONITORED RETRIEVABLE STORAGE (MRS) FACILITY, IF AUTHORIZED
- ENSURING CHARACTERIZATION OF THE FIRST REPOSITORY CANDIDATE SITES
- ENGINEERING AND DEVELOPMENT OF THE SELECTED FIRST REPOSITORY SITE THROUGH RECEIPT OF NRC CONSTRUCTION AUTHORIZATION
- FIRST REPOSITORY TITLE III DESIGN/INSPECTION AND OPERATIONS SUPPORT TO DOE AND THE SELECTED REPOSITORY OPERATOR

MA51734T.096

WORKSCOPE SUMMARY
CONTINUED

- INTEGRATION WITH AND ASSISTANCE TO SECOND REPOSITORY PROGRAM PARTICIPANTS
- DESIGN AND LICENSING SERVICES FOR THE MRS, IF AUTHORIZED*
- INTEGRATION OF THE WORK PERFORMED BY VARIOUS PROGRAM PARTICIPANTS
  - NATIONAL LABORATORIES
  - OTHER FEDERAL AGENCIES
  - PRIME CONTRACTORS
- ASSISTANCE IN AFFECTED STATE AND INDIAN TRIBE CONSULTATION AND COOPERATION ACTIVITIES

*PENDING A DOE CONTRACT DECISION REGARDING DETAILED DESIGN, CONSTRUCTION, AND OPERATION

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II. PROGRAM MANAGEMENT, ORGANIZATION, AND SCHEDULE

A. PROGRAM MANAGEMENT AND ORGANIZATION
  1. PROGRAM MANAGEMENT PLANS AND PROCEDURES
  2. PROGRAM ORGANIZATIONAL RESPONSIBILITIES
    A. DEPARTMENT OF ENERGY - HEADQUARTERS
    B. SYSTEMS ENGINEERING, DEVELOPMENT, AND MANAGEMENT CONTRACTOR
    C. FIRST REPOSITORY PROJECT OFFICES
    D. MONITORED RETRIEVABLE STORAGE PROJECT OFFICE
    E. OTHER DOE OPERATIONS OFFICES
    F. CONTRACTORS PERFORMING OTHER OCRWM WORKSCOPE
B. PROGRAM SCHEDULE

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ORGANIZATIONAL RESPONSIBILITIES

-DOE-HQ-

- ENSURE NWPA REQUIREMENTS ARE MET
- MANAGE SEDM CONTRACT AND OTHER HQ PRIME CONTRACTORS
- ESTABLISH OVERALL PROGRAM REQUIREMENTS; APPROVE IMPLEMENTING PLANS
- APPROVE AND CONTROL COST, SCHEDULE, AND TECHNICAL BASELINES
- ASSIGN WORKSCOPE, AND PROVIDE BUDGET GUIDANCE AND DIRECTION
- SUBMIT LICENSE APPLICATIONS TO NRC
- SERVE AS POINT OF CONTACT WITH CONGRESS, NRC, OTHER FEDERAL AGENCIES, AND AFFECTED STATES AND INDIAN TRIBES

MA51734T.099

ORGANIZATIONAL RESPONSIBILITIES

- SEDM CONTRACTOR -

- MINIMUM OFFICE LOCATIONS
  - WASHINGTON D.C. METROPOLITAN AREA
  - THE 3 FIRST REPOSITORY CANDIDATE SITES
  - THE MRS SITE (IF AUTHORIZED)

  IN ADDITION TO ANY CENTRAL WORK OFFICE NOT LOCATED ABOVE
- CONTRACTUALLY AND TECHNICALLY REPORT TO DOE-HQ
- IMPLEMENT NUCLEAR WASTE MANAGEMENT SYSTEM DESIGN AND INTEGRATION DIRECTION FROM DOE-HQ
- PROVIDE TECHNICAL, SCHEDULE, AND BUDGET DIRECTION TO FIRST REPOSITORY PROGRAM PARTICIPANTS
- IMPLEMENT DIRECTION FROM MRS PROJECT OFFICE
- IMPLEMENT TRANSPORTATION PROGRAM DIRECTION FROM DOE-HQ
- EXCHANGE INFORMATION WITH SECOND REPOSITORY AND OTHER PROGRAM PARTICIPANTS

MA51734T.100

FIGURE II.1

CURRENT PROGRAM ORGANIZATION

- FIRST REPOSITORY -

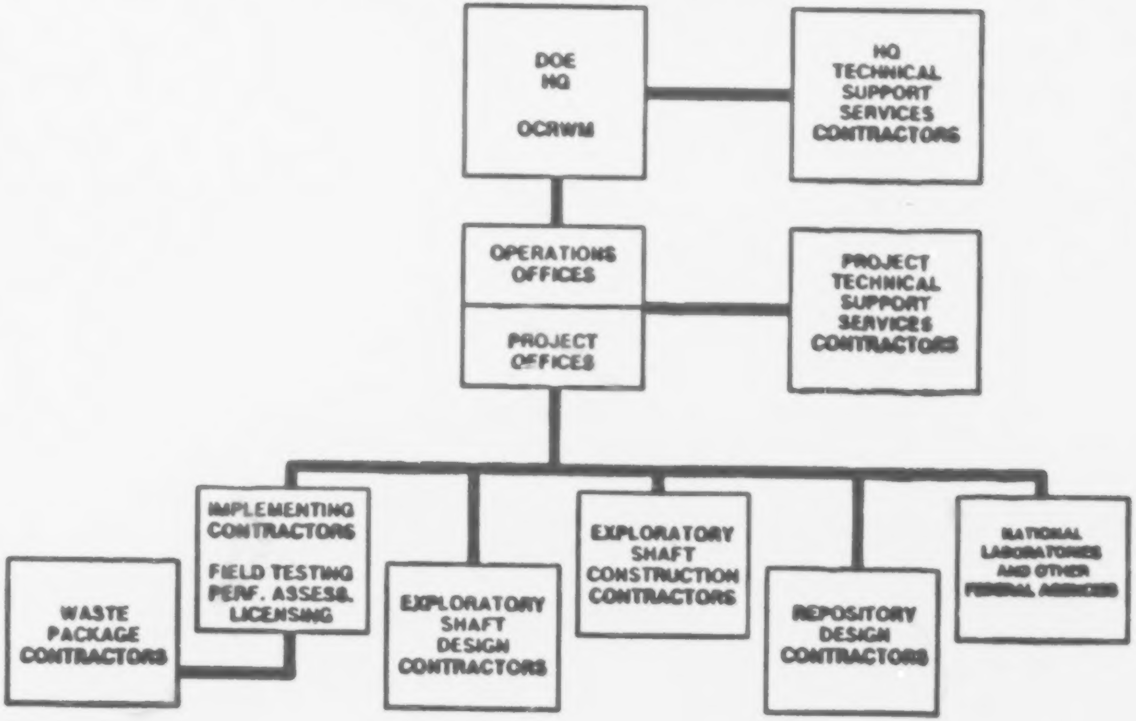
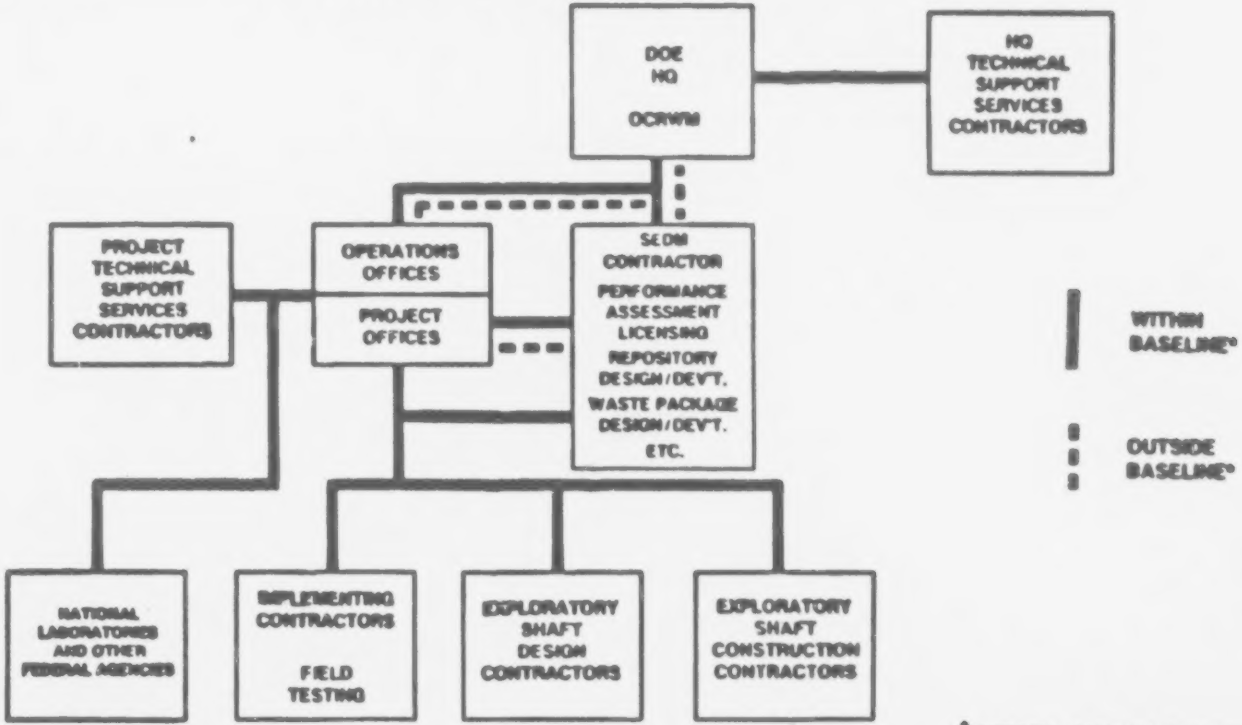

DOE
HQ
OCRWM
HQ
TECHNICAL
SUPPORT
SERVICES
CONTRACTORS
OPERATIONS
OFFICES
PROJECT
OFFICES
PROJECT
TECHNICAL
SUPPORT
SERVICES
CONTRACTORS
IMPLEMENTING
CONTRACTORS
FIELD TESTING
PERF. ASSESS.
LICENSING
WASTE
PACKAGE
CONTRACTORS
EXPLORATORY
SHAFT
DESIGN
CONTRACTORS
EXPLORATORY
SHAFT
CONSTRUCTION
CONTRACTORS
REPOSITORY
DESIGN
CONTRACTORS
NATIONAL
LABORATORIES
AND OTHER
FEDERAL AGENCIES

FIGURE II.2
PLANNED PROGRAM ORGANIZATION
- FIRST REPOSITORY -

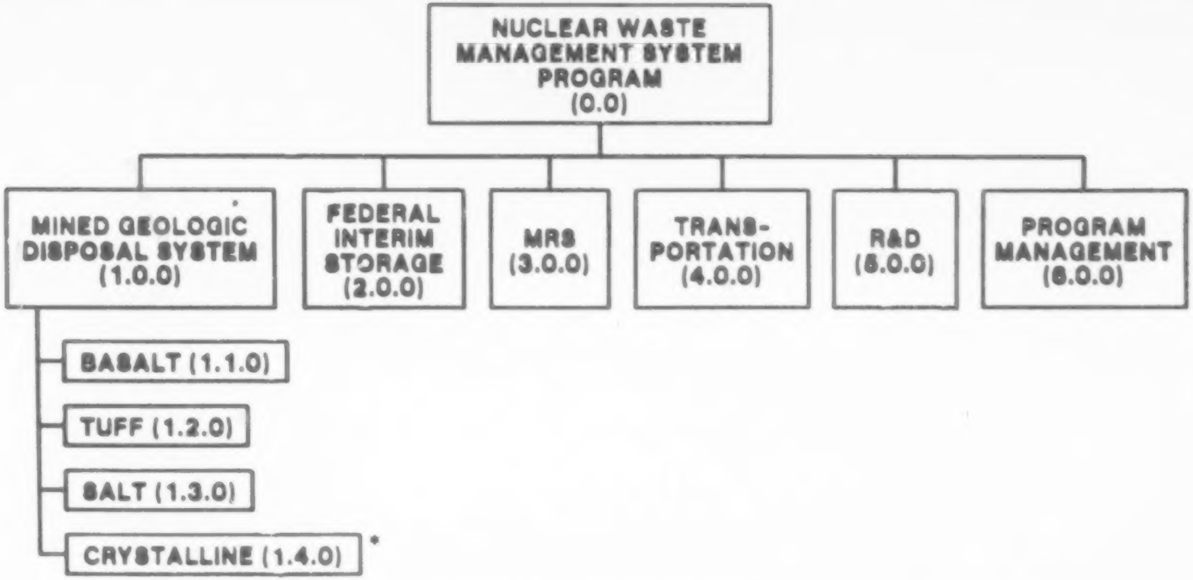

DOE
HQ
OCRWM
HQ
TECHNICAL
SUPPORT
SERVICES
CONTRACTORS
PROJECT
TECHNICAL
SUPPORT
SERVICES
CONTRACTORS
OPERATIONS
OFFICES
PROJECT
OFFICES
SEDM
CONTRACTOR
PERFORMANCE
ASSESSMENT
LICENSING
REPOSITORY
DESIGN/DEV'T.
WASTE PACKAGE
DESIGN/DEV'T.
ETC.
WITHIN
BASELINE*
OUTSIDE
BASELINE*
NATIONAL
LABORATORIES
AND OTHER
FEDERAL AGENCIES
IMPLEMENTING
CONTRACTORS
FIELD
TESTING
EXPLORATORY
SHAFT
DESIGN
CONTRACTORS
EXPLORATORY
SHAFT
CONSTRUCTION
CONTRACTORS

* TECHNICAL, SCHEDULE, AND BUDGET

III. DESCRIPTION OF WORK

- A. INTRODUCTION
- B. OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT PROGRAM WORK BREAKDOWN STRUCTURE
- C. WORKSCOPE DESCRIPTION BY WORK BREAKDOWN STRUCTURE ELEMENT
  - 1. MINED GEOLOGIC DISPOSAL SYSTEM
    - a. FIRST REPOSITORY
    - b. SECOND REPOSITORY
  - 2. FEDERAL INTERIM STORAGE
  - 3. MONITORED RETRIEVABLE STORAGE
  - 4. TRANSPORTATION
  - 5. RESEARCH AND DEVELOPMENT
  - 6. PROGRAM MANAGEMENT

PROGRAM WBS


NUCLEAR WASTE MANAGEMENT SYSTEM PROGRAM (0.0)
MINED GEOLOGIC DISPOSAL SYSTEM (1.0.0)
FEDERAL INTERIM STORAGE (2.0.0)
MRS (3.0.0)
TRANS-PORTATION (4.0.0)
R&D (5.0.0)
PROGRAM MANAGEMENT (6.0.0)
BASALT (1.1.0)
TUFF (1.2.0)
SALT (1.3.0)
CRYSTALLINE (1.4.0) *

*NOW CALLED "REPOSITORY TECHNOLOGY DEVELOPMENT"

MA51734T.119

WORKSCOPE DESCRIPTION

- FIRST REPOSITORY -

- SEDM CONTRACTOR TO ENSURE ALL DELIVERABLES WILL MEET NRC LICENSING REQUIREMENTS DURING
  - SITE CHARACTERIZATION
  - DESIGN THROUGH TITLE III
  - LICENSING PROCESS
- SEDM CONTRACTOR TO PROVIDE SUPPORT TO DOE AND REPOSITORY OPERATING CONTRACTOR FOR OPERATING LICENSE PREPARATION.
- FOR FIELD-RELATED SITE CHARACTERIZATION WORK, SEDM CONTRACTOR SHALL UTILIZE EXISTING CONTRACTORS
  - BOREHOLE DRILL/TEST
  - GEOPHYSICAL TESTING
  - INSITU TESTING
  - ETC.
- FOR OTHER WORK, SEDM CONTRACTOR IS RESPONSIBLE TO CARRY OUT SUCH WORK, UTILIZING EXISTING PARTICIPANTS TO EXTENT FEASIBLE
  - WASTE PACKAGE DESIGN/DEVELOPMENT
  - MATERIALS TESTING
  - REPOSITORY & SEALS DESIGN
  - ETC.

MA51734T.102

WORKSCOPE DEFINITION

- FIRST REPOSITORY -
(CONTINUED)

- SYSTEMS
- WASTE PACKAGE
- SITE
- REPOSITORY
- REGULATORY AND INSTITUTIONAL
- EXPLORATORY SHAFT
- TEST FACILITIES
- LAND ACQUISITION
- PROJECT MANAGEMENT

MA51734T.103

WORKSCOPE DESCRIPTION

- SECOND REPOSITORY -

- SEDM CONTRACTOR TO INTEGRATE SECOND REPOSITORY REQUIREMENTS WITH THE NUCLEAR WASTE MANAGEMENT SYSTEM
- SEDM CONTRACTOR TO ASSIST SECOND REPOSITORY PROGRAM PARTICIPANTS
  - ENSURE NWPA COMPLIANCE
  - ENSURE TRANSFER OF FIRST REPOSITORY PROGRAM INFORMATION
  - DEVELOP CONCEPTUAL DESCRIPTIONS AND DATA REQUIREMENTS/ANALYSES OF FACILITIES AND ENGINEERED COMPONENTS, AS DIRECTED BY DOE-HQ
- SEDM CONTRACTOR TO ENSURE TRANSFER OF INTERNATIONAL COOPERATIVE EFFORTS INFORMATION TO PROGRAM PARTICIPANTS

MA51734T.104

WORKSCOPE DESCRIPTION

- FEDERAL INTERIM STORAGE -

- SEDM CONTRACTOR NOT RESPONSIBLE FOR THIS WBS ELEMENT

MA51734T.105

WORKSCOPE DESCRIPTION

- MONITORED RETRIEVABLE STORAGE -

- SHOULD DOE RECEIVE CONGRESSIONAL APPROVAL FOR MRS CONSTRUCTION, SEDM CONTRACTOR WILL BE REQUIRED TO PROVIDE MRS DESIGN AND LICENSING SERVICES
- SEDM CONTRACTOR WOULD CONTINUE SUCH SERVICES UNLESS & UNTIL DOE HAS MADE A PROCUREMENT DECISION TO TRANSFER MRS DETAILED DESIGN, CONSTRUCTION, AND OPERATION TO A SEPARATE REQUIREMENT (TO BE COMPETED)
- SEDM CONTRACTOR WILL CONTINUE OVERALL NUCLEAR WASTE MANAGEMENT SYSTEM INTEGRATION IN THE EVENT OF SUCH A TRANSFER

MA51734T.106

WORKSCOPE DESCRIPTION

- MONITORED RETRIEVABLE STORAGE - (CONTINUED)

- ENVIRONMENTAL EVALUATIONS
- DESIGN
- REGULATORY COMPLIANCE
- CONSTRUCTION*
- QUALITY ASSURANCE
- OPERATIONS*
- INSTITUTIONAL INTERACTIONS
- PROJECT MANAGEMENT

*SEDM CONTRACTOR NOT RESPONSIBLE FOR THIS WBS ELEMENT

MA51734T.107

WORKSCOPE DESCRIPTION

- TRANSPORTATION -

- CASK SYSTEMS DEVELOPMENT*
- SUPPORT SYSTEMS DEVELOPMENT*
- OPERATIONS*
- INSTITUTIONAL PLANNING AND ANALYSIS*
- SYSTEMS ANALYSIS
- MANAGEMENT AND INTEGRATION

*SEDM CONTRACTOR NOT RESPONSIBLE FOR THIS WBS ELEMENT

MA51734T.108

WORKSCOPE DESCRIPTION
- RESEARCH AND DEVELOPMENT -

- R&D WORK IS FUNDED UNDER THE CIVILIAN R&D PROGRAM APPROPRIATION
  - SUBSEABED
  - DRY STORAGE
  - ROD CONSOLIDATION
- SEDM CONTRACTOR NOT RESPONSIBLE FOR THIS WORK

WORKSCOPE DESCRIPTION
- PROGRAM MANAGEMENT -

- PROGRAM DIRECTION*
- SYSTEMS INTEGRATION
- POLICY**
- OUTREACH**
- ADMINISTRATION**
- FUND MANAGEMENT**
- QUALITY ASSURANCE
- TECHNICAL SUPPORT**

* NOT APPLICABLE
** SEDM CONTRACTOR NOT RESPONSIBLE FOR THIS WBS ELEMENT

MA51734T.110

IV. MANAGEMENT CONTROL SYSTEM

A. OVERVIEW OF MANAGEMENT CONTROL SYSTEM REQUIREMENTS

B. PROJECT MANAGEMENT CONTROL SYSTEM
   1. PROJECT MANAGEMENT FUNCTIONS
   2. PROJECT MANAGEMENT SYSTEM REQUIREMENTS
   3. PROJECT MANAGEMENT PLAN

C. TECHNICAL CONTROL SYSTEM
   1. SYSTEMS ENGINEERING MANAGEMENT PLAN
   2. WORK PLANS

D. QUALITY ASSURANCE
   1. QUALITY ASSURANCE FUNCTIONS
   2. QUALITY ASSURANCE REQUIREMENTS
   3. QUALITY ASSURANCE PLAN

E. MANAGEMENT CONTROL SYSTEM PROCEDURES

MA51734T.111

MANAGEMENT CONTROL SYSTEM
- OVERVIEW -

- SEDM CONTRACTOR'S MANAGEMENT CONTROL SYSTEM MUST MEET OCRWM REQUIREMENTS, AND RELEVANT DOE ORDERS, SUCH AS
  - OCRWM PROGRAM MANAGEMENT SYSTEM (PMS) MANUAL
  - DOE 4700.1, PROJECT MANAGEMENT SYSTEM
  - DOE 2250.1B, COST AND SCHEDULE CONTROL SYSTEM CRITERIA FOR CONTRACT PERFORMANCE MEASUREMENTS
- UPON AWARD, SEDM CONTRACTOR SHALL PREPARE
  - PROJECT MANAGEMENT PLAN (PMP)
  - SYSTEMS ENGINEERING MANAGEMENT PLAN (SEMP)
  - QUALITY ASSURANCE PLAN (QAP)
- THESE 3 PLANS WILL IDENTIFY REQUIRED PLANS AND PROCEDURES TO BE PREPARED BY THE SEDM CONTRACTOR TO ENSURE CONTROL OF WORKSCOPE AND ACTIVITIES

MA51734T.112

PROJECT MANAGEMENT CONTROL SYSTEM

- SEDM CONTRACTOR SHALL PERFORM THESE MINIMUM FUNCTIONS:
  - ESTABLISH, MAINTAIN, AND OPERATE A PROJECT MANAGEMENT SYSTEM AND A DOCUMENT CONTROL SYSTEM.
  - PERFORM INTERNAL CONTRACT MANAGEMENT & CONTROL ACTIVITIES
  - MAINTAIN AND OPERATE CONTRACT-RELATED PARTS OF THE INFORMATION MANAGEMENT SYSTEM (IMS)
- THE PMP, TO BE APPROVED BY DOE-HQ, SHALL CONTAIN DOE 4700.1 RECOMMENDED INFORMATION AND OCRWM PMS MANUAL INFORMATION
- MAJOR SYSTEM ACQUISITION REQUIREMENTS IN DOE 4700.1 APPLY TO SEDM CONTRACTOR WORK ON THE FIRST REPOSITORY AND MRS (IF AUTHORIZED)
- SEDM CONTRACTOR WILL BE REQUIRED TO ESTABLISH A PERFORMANCE MEASUREMENT SYSTEM THAT CAN BE VALIDATED PER THE COST/SCHEDULE CONTROL SYSTEM CRITERIA (C/SCSC) IN DOE 2250.1B

MA51734T.113

TECHNICAL CONTROL SYSTEM

- SEDM CONTRACTOR SHALL PREPARE A SEMP, TO BE APPROVED BY DOE-HQ, THAT IMPLEMENTS THE OCRWM PROGRAM TECHNICAL CONTROL REQUIREMENTS SPECIFIED IN THE OCRWM SEMP

- SEDM CONTRACTOR'S SEMP SHALL INCLUDE OR ADDRESS:
  - IDENTIFICATION OF IMPLEMENTING TECHNICAL PROCEDURES & PLANS
  - SYSTEM ENGINEERING APPROACH
  - CONFIGURATION CONTROL
  - DESIGN REVIEWS
  - TEST MANAGEMENT
  - SOFTWARE CONTROL
  - TECHNICAL INTERFACE CONTROL
  - PERFORMANCE ASSESSMENT METHODOLOGY
  - TECHNICAL DECISION DOCUMENTATION

- SEDM CONTRACTOR SHALL PREPARE TECHNICAL WORK PLANS, TO BE APPROVED BY DOE-HQ, FOR MAJOR CONTRACT ACTIVITIES TO ENSURE ADEQUACY AND APPROPRIATE PROGRAM INTEGRATION

QUALITY ASSURANCE

- SEDM CONTRACTOR SHALL PERFORM THESE MINIMUM FUNCTIONS:
  - DEVELOP AND IMPLEMENT AN INTERNAL QA PROGRAM PLAN, TO BE APPROVED BY DOE-HQ AND NRC
  - DEVELOR ALL NECESSARY IMPLEMENTING PROCEDURES
  - PERFORM AND ANALYZE AUDITS, SURVEILLANCES, ETC. TO VERIFY QA PLAN IMPLEMENTATION
  - ASSIST DOE IN ITS QA ACTIVITIES AND DOCUMENT PREPARATION
  - DEVELOP AND CONDUCT QA INDOCTRINATION AND TRAINING
  - REVIEW REPORTS AND DOCUMENTS FOR QA REQUIREMENTS COMPLIANCE
  - REVIEW OTHER PROGRAM PARTICIPANTS' QA PLANS AND PROCEDURES
- SEDM CONTRACTOR QA PROGRAM SHALL MEET APPLICABLE REQUIREMENTS OF ANSI/ASME NQA-1, ETC

MA51734T.116

V. TRANSITION PERIOD

A. SUMMARY OF TRANSITION PERIOD

B. TRANSITION PLAN

C. AUTHORIZATION TO PERFORM TECHNICAL WORK

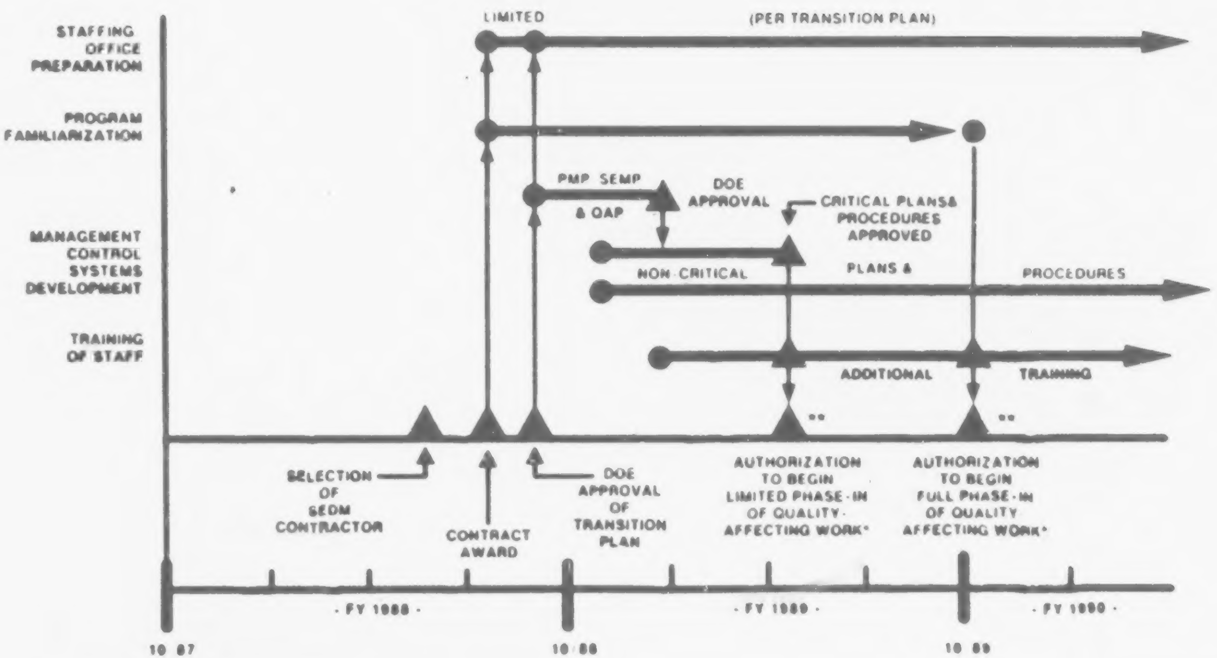
D. TRANSITION OF WORK TO THE SYSTEMS ENGINEERING, DEVELOPMENT, AND MANAGEMENT CONTRACTOR

1. STATUS OF EXISTING CONTRACTS
2. TRANSITION OF WORK TO THE SYSTEMS ENGINEERING, DEVELOPMENT, AND MANAGEMENT CONTRACTOR

E. TRANSITION OF SYSTEMS ENGINEERING, DEVELOPMENT, AND MANAGEMENT CONTRACTOR WORK TO MRS CONTRACTOR

MA51734T.115

TRANSITION


STAFFING OFFICE PREPARATION
PROGRAM FAMILIARIZATION
MANAGEMENT CONTROL SYSTEMS DEVELOPMENT
TRAINING OF STAFF
LIMITED
(PER TRANSITION PLAN)
PMP SEMP & QAP
DOE APPROVAL
CRITICAL PLANS& PROCEDURES APPROVED
NON-CRITICAL
PLANS &
PROCEDURES
ADDITIONAL
TRAINING
**
**
SELECTION OF SEDM CONTRACTOR
CONTRACT AWARD
DOE APPROVAL OF TRANSITION PLAN
AUTHORIZATION TO BEGIN LIMITED PHASE-IN OF QUALITY-AFFECTING WORK*
AUTHORIZATION TO BEGIN FULL PHASE-IN OF QUALITY AFFECTING WORK*
- FY 1988 -
- FY 1989 -
- FY 1990 -
10/87
10/88
10/89

*SEE TABLE V 2 FOR IMPLEMENTATION OF WORK FROM EXISTING CONTRACTORS

**READINESS REVIEW(S) SUCCESSFULLY COMPLETED

MA51734T.002

TRANSITION PLAN

- CONTENTS -

- ORGANIZATION
- STAFFING
- OFFICE LOCATIONS
- DEVELOPMENT/IMPLEMENTATION OF MANAGEMENT CONTROL SYSTEMS
- FAMILIARIZATION APPROACH
- TRAINING
- READINESS PROCESS
- MILESTONES AND SCHEDULES

MA51734T.117

POTENTIAL TRANSITION OF WORKSCOPE TO SEDM CONTRACTOR

- SOW, TABLE V.1, "MAJOR PRIME CONTRACTORS PERFORMING RELATED WORKSCOPE FOR OCRWM"
    - CONTRACTOR NAME
    - SCOPE OF WORK/CONTRACT #/CONTRACT TITLE
    - WBS #
    - WORKSCOPE PERFORMED FOR
    - CONTRACT PERIOD

- SOW, TABLE V.2, "POTENTIAL TRANSITION OF WORKSCOPE TO SEDM CONTRACTOR"
    - CONTRACTOR NAME
    - SCOPE OF WORK/CONTRACT #
    - ANTICIPATED PHASE-IN DATE
    - POTENTIALLY AVAILABLE DELIVERABLES

MA51734T.118

PROCUREMENT PRESENTATION
OVERVIEW

- COMPETITION CONSIDERATIONS
- ORGANIZATIONAL CONFLICTS OF INTEREST
- CONTRACT TYPE

MA51734T.075

COMPETITION CONSIDERATIONS

- STEPS TO ENSURE FULL AND OPEN COMPETITION
- COMPETITION PROCESS

STEPS TO ENSURE FULL AND OPEN COMPETITION

- OCI GUIDELINES
- PUBLIC READING ROOMS
- SOW
- CONFERENCES

MA51734T.077

COMPETITION PROCESS

- UNRESTRICTED RFP
- SEB PROCEDURES

MA51734T.078

ORGANIZATIONAL CONFLICTS OF INTEREST (OCI)

- DEFINITION--DEAR PART 909.5
- GUIDELINES

MA51734T.079

OCI DEFINITION -- DEAR 909.570-3

"ORGANIZATIONAL CONFLICTS OF INTEREST" MEANS THAT A RELATIONSHIP OR SITUATION EXISTS WHEREBY AN OFFEROR OR CONTRACTOR (INCLUDING CHIEF EXECUTIVES AND DIRECTORS, TO THE EXTENT THAT THEY WILL OR DO BECOME INVOLVED IN THE PERFORMANCE OF THE CONTRACT, AND PROPOSED CONSULTANTS OR SUBCONTRACTORS WHERE THEY MAY BE PERFORMING SERVICES SIMILAR TO THE SERVICES PROVIDED BY THE PRIME) HAS PAST, PRESENT, OR CURRENTLY PLANNED INTERESTS THAT EITHER DIRECTLY OR INDIRECTLY, THROUGH A CLIENT RELATIONSHIP RELATE TO THE WORK TO BE PERFORMED UNDER A DEPARTMENT CONTRACT AND WHICH (1) MAY DIMINISH ITS CAPACITY TO GIVE IMPARTIAL, TECHNICALLY SOUND, OBJECTIVE ASSISTANCE, AND ADVICE, OR (2) MAY RESULT IN IT BEING GIVEN AN UNFAIR COMPETITIVE ADVANTAGE. IT DOES NOT INCLUDE THE NORMAL FLOW OF BENEFITS FROM THE PERFORMANCE OF THE CONTRACT.

MA51734T.080

OCI GUIDELINES PURPOSE

- ADDRESS AREAS OF POTENTIAL OCI FOR OCRWM INCUMBENTS
- FURTHER PROMOTE FULL AND OPEN COMPETITION

OCI GUIDELINES CONTENTS

- FAIR COMPETITIVE ADVANTAGE
- UNFAIR COMPETITIVE ADVANTAGE
- BIAS
- PROPOSAL PREPARATION CONFLICTS
- REPRESENTATION OR DISCLOSURE CERTIFICATION
- QUESTIONNAIRE
- SSO DETERMINATION

MA51734T.082

CONTRACT TYPE

- MANAGEMENT AND OPERATING (M&O) CONTRACT
- COST-PLUS-AWARD-FEE

MA51734T.083

MANAGEMENT & OPERATING (M&O) CONTRACT

- BACKGROUND AND UNIQUE ASPECTS
- SPECIAL TERMS AND CONDITIONS

MA51734T.084

M&O CONTRACT BACKGROUND AND UNIQUE ASPECTS

- BACKGROUND
  - DATES BACK TO WWII MANHATTAN ENGINEER DISTRICT PROJECT
- UNIQUE ASPECTS
  - LONG-TERM CLOSE WORKING RELATIONSHIP IN PURSUIT OF AGENCY MISSION.
  - CONTRACTOR HIRED TO MANAGE; GOVERNMENT RETAINS OVERALL PROGRAM MANAGEMENT AND TECHNICAL DIRECTION RESPONSIBILITIES
  - GOVERNMENT ULTIMATELY RESPONSIBLE FOR SECURITY, HEALTH, AND SAFETY

MA51734T.085

M&O SPECIAL TERMS AND CONDITIONS

- COST REIMBURSEMENT TYPE WITH COST ALLOWABILITY DETERMINED PER DEAR COST PRINCIPLES AND CONTRACT TERMS
- COMPETE/EXTEND REVIEW CYCLE
- ANNUAL NEGOTIATIONS OF WORK PROGRAM AND CORRESPONDING BUDGET AND FEE
- LETTER OF CREDIT FINANCING
- INTEGRATED ACCOUNTING SYSTEM
- SUBCONTRACTING APPROVALS

MA51734T.086

CPAF DEFINITION - FAR 16.404-2

"A COST-PLUS-AWARD-FEE CONTRACT IS A COST-REIMBURSEMENT CONTRACT THAT PROVIDES FOR A FEE CONSISTING OF (1) A BASE AMOUNT FIXED AT INCEPTION OF THE CONTRACT AND (2) AN AWARD AMOUNT THAT THE CONTRACTOR MAY EARN IN WHOLE OR IN PART DURING PERFORMANCE AND THAT IS SUFFICIENT TO PROVIDE MOTIVATION FOR EXCELLENCE IN SUCH AREAS AS QUALITY, TIMELINESS, TECHNICAL INGENUITY, AND COST-EFFECTIVE MANAGEMENT. THE AMOUNT OF THE AWARD FEE TO BE PAID IS DETERMINED BY THE GOVERNMENT'S JUDGMENTAL EVALUATION OF THE CONTRACTOR'S PERFORMANCE IN TERMS OF THE CRITERIA STATED IN THE CONTRACT. THIS DETERMINATION IS MADE UNILATERALLY BY THE GOVERNMENT AND IS NOT SUBJECT TO THE DISPUTES CLAUSE."

MA51734T.087

OCRWM RFP READING ROOMS

- DOE PUBLIC READING ROOMS WILL BE UTILIZED TO PROVIDE POTENTIAL BIDDERS AND MEMBERS OF THE PUBLIC WITH OCRWM PROGRAM INFORMATION DEEMED RELEVANT TO THIS RFP
- READING ROOM MATERIAL WILL BE AVAILABLE AT DOE READING ROOM SITES IN MICROFICHE FORM. IN ADDITION, HARD COPY FORM WILL BE AVAILABLE FOR VIEWING AT THE SAN FRANCISCO PUBLIC READING ROOM, THE SERI AREA OFFICE IN GOLDEN, COLORADO AND AT THE DOE HEADQUARTERS PUBLIC READING ROOM
- MICROFICHE COPIES OF THE OCRWM READING ROOM MATERIAL WILL BE AVAILABLE FOR SALE TO INTERESTED PARTIES

- READING ROOMS WILL REMAIN OPEN UNTIL THE RFP CLOSES
- READING ROOM CONTENTS WILL REMAIN FIXED WITH THE EXCEPTION OF A ONE-TIME UPDATE APPROXIMATELY ONE MONTH AFTER THE RFP IS RELEASED
- YOUR HANDOUT CONTAINS
  - THE INVENTORY LISTING OF THE OCRWM READING ROOM MATERIAL
  - A LIST OF READING ROOM LOCATIONS
  - A POINT OF CONTACT FOR EACH READING ROOM
  - INFORMATION RELATED TO THE PURCHASE OF MICROFICHE COPIES OF THE COMPLETE OCRWM READING ROOM MATERIAL

MA51734T.091

RFP SCHEDULE

● SOLICITATION ISSUED	AUGUST 1987
● PREPROPOSAL CONFERENCE	SEPTEMBER 1987
● RECEIPT OF PROPOSALS	NOVEMBER 1987
● CONTRACTOR SELECTION	MAY 1988

MA51734T.092

PRESOLICITATION CONFERENCE

CONCLUSION

- POINT OF CONTACT

  ALETA EGELAND
  CONTRACTING OFFICER
  U.S. DEPARTMENT OF ENERGY
  1000 INDEPENDENCE AVENUE, SW
  WASHINGTON, D.C. 20585

  (202) 586-1360

- WRAP-UP

MA51734T.088

DOE/RW-0101

Office of Civilian Radioactive Waste Management

Office of Geologic Respositories

Issues Hierarchy For A Mined Geologic Disposal System

(OGR/B-10)

September 1986

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

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DOE/RW-0101

Office of Civilian Radioactive Waste Management

Office of Geologic Respositories

Issues Hierarchy For A Mined Geologic Disposal System

(OGR/B-10)

September 1986

U.S. Department of Energy
Office of Civilian Radioactive Waste Management
Washington, D.C. 20585

FOREWORD

The Nuclear Waste Policy Act of 1982 (NWPA) charges the Department of Energy (DOE) with responsibility for siting, constructing, operating, and permanently closing a mined geologic disposal system (MGDS) for high-level nuclear waste and spent nuclear fuel. The Nuclear Regulatory Commission (NRC) is charged with responsibility for promulgating the regulatory requirements and criteria (10 CFR Part 60) that will govern authorization for construction, licensing, and approval for permanent closure of the MGDS.

The NWPA also requires that the DOE prepare, and the NRC adopt to the extent practicable, an environmental impact statement (EIS) to satisfy the requirements of the National Environmental Policy Act (NEPA) and the implementing regulations of 40 CFR Part 1500 et seq. These implementing regulations require that the DOE undertake a scoping process to identify the significant issues to be addressed in the EIS.

In 10 CFR Part 60, and in their guidance (Proposed Revision 1 to Regulatory Guide 4.17) to the DOE for the preparation of site characterization plans (SCPs) for geologic repositories, the NRC has indicated that identification of the issues that must be resolved to complete licensing assessments of site and design suitability is an important step in the licensing process.

As required by the NWPA, the DOE prepared a Mission Plan for the Civilian Radioactive Waste Management Program (the Mission Plan, DOE/RW-0005) to provide an informational basis sufficient to permit informed decisions to be made in carrying out the program for development of the MGDS. To address the NWPA requirement that the information needed to support siting and construction of the MGDS be identified, the Mission Plan included a hierarchy of generic issues derived from the applicable Federal regulations that define the requirements for the MGDS, and that must be resolved to demonstrate that these requirements have been satisfied.

The Office of Geologic Repositories (OGR) within the DOE's Office of Civilian Radioactive Waste Management (OCRWM) has primary responsibility for the MGDS program. The OGR Issues Hierarchy for a Mined Geologic Disposal System (the OGR Issues Hierarchy, DOE/RW-00xx) that follows is based on the issues hierarchy concept presented in the DOE's Mission Plan. The OGR Issues Hierarchy presents the issues that the DOE will use to guide development of site characterization plans and the conduct of site characterization activities. These issues must be resolved to demonstrate compliance with applicable Federal regulations and to support site selection and licensing for an MGDS. Specific questions that may be identified during the licensing process and in the development of an EIS are encompassed by the general issues statements in the OGR Issues Hierarchy. The OGR Issues Hierarchy is limited to the issues related to siting and licensing requirements of applicable Federal regulations, and does not address the requirements of other regulations or functional or operating requirements for the MGDS, or requirements for integation and design/operational efficiency of the MGDS. Although the DOE believes that this document contains a comprehensive set of siting and licensing issues, it will be revised as necessary during site characterization to encompass any additional issues that may arise.

Foreword (continued)

This document is a reprint of the original distribution of uncontrolled copies of OGR/B-10 by William Purcell's memorandum dated August 21, 1986. The document number DOE/RW-0101 has been added to the cover. This document will also continue to be identified as OGR/B-10. This document is not baselined.

The OGR Issues Hierarchy is a formal programmatic change controlled document and is effective immediately. Its implementation will follow all standard procedures prescribed by the program's baseline procedure (see OGR/B-1). Any changes to this document must be made formally through the change control procedure. It is to be implemented by each of the Project Offices in their preparation of Site Characterization Plans and should specifically be incorporated into Sections 8.1, 8.2, and 8.3.

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1. INTRODUCTION

The Office of Geologic Repositories (OGR) has adopted an issues hierarchy for use by all Project Offices. The issues hierarchy provides a framework for representing issues related to regulatory requirements for siting and licensing a mined geologic disposal system (MGDS) and for describing the work that needs to be completed during site characterization to resolve those issues. The issues in the issues hierarchy are defined as the questions relating to the performance of the MGDS that must be resolved to demonstrate compliance with the applicable Federal regulations (including 10 CFR Part 60, 10 CFR Part 960, 40 CFR Part 191, and 10 CFR Part 20).

The issues hierarchy is structured around four broad areas of regulatory concern related to the requirements for siting and licensing an MGDS (postclosure performance, preclosure radiological safety, non-radiological environmental impacts, and feasibility and cost of MGDS development), and provides the framework for definition of the information needed to satisfy the applicable regulatory requirements in each of these areas. As such, the issues hierarchy does not specify the requirements that the MGDS must satisfy but rather defines issues related to those requirements associated with siting and licensing. The "Generic Requirements for a Mined Geologic Disposal System," (OGR B-2) (the GR) and the associated requirements documents prepared by the Projects specify the requirements that must be satisfied by the MGDS. The GR in combination with the Project-level requirements documents address all aspects of the MGDS, including siting and licensing. The issues hierarchy and the GR are linked by an issue resolution strategy and performance allocation process (see Section 6) that leads to identification of the system elements that will be relied on to resolve the issue by meeting the related regulatory performance objectives and design criteria.

The OGR issues hierarchy was developed to provide a common basis for all Project Offices to plan site characterization activities. It will be used in preparing the site characterization plans for each site to be characterized, and in reporting the status of site characterization activities via semiannual progress reports. The specific use of this hierarchy for other purposes has not yet been defined by OGR.

The purpose of this document is to present the issues hierarchy, describe the rationale used to develop the hierarchy, and describe how the issues hierarchy is used in program planning. Section 2 presents the overall rationale for the issues hierarchy, and explains the structure and organization of the hierarchy. Section 3 presents the issues hierarchy itself and Section 4 describes the basis for the development of individual issues. Section 5 provides a correlation between the issues and the applicable Federal regulations being addressed. Section 6 describes how the issues drive development of plans in support of siting and licensing requirements through use of an issue resolution strategy that includes performance allocation.

2. RATIONALE FOR DEVELOPMENT AND STRUCTURE OF THE ISSUES HIERARCHY

The issues hierarchy consists of three levels of detail: key issues, issues, and information needs. This structure provides a convenient means to distinguish broad questions of overall suitability (key issues) from: 1) more specific questions (issues) about characteristics of the site, features of the design, and performance of the system, and 2) requirements for the basic information (information needs) used to answer the specific questions. The portion of the issues hierarchy presented in Section 3 of this document and intended for common use by all Project Offices includes the key issues and the issues but does not include information needs. The information needs required to resolve each issue will be developed on a site-specific basis and will be fully presented in the individual site characterization plans and other program documents.

Key Issues relate to broad-level technical or institutional requirements grouped into four topical areas relating to the overall performance of the site, as identified by the DOE Siting Guidelines, 10 CFR Part 960.

Issues are subordinate to key issues. Collectively, the group of issues under a key issue indicates what questions must be answered to satisfy the key issue. Taken together, the issues provide a conceptual outline to structure the resolution strategies for each key issue. The issues are derived, in part, from the technical guidelines of 10 CFR Part 960, from the performance objectives and design criteria of 10 CFR Part 60, and from the requirements of 40 CFR Part 191.

Information Needs represent information required to resolve issues and form the third level of the hierarchy. Although generally similar for all sites, information needs will be developed for each candidate site taking into account site-specific differences. Additional levels may be used, as appropriate, to identify the lowest level of detail required.

The issues hierarchy presented in Section 3 is based on the issues hierarchy concept presented in the Mission Plan (DOE/RW-0005, June 1985, Volume 1, Part II, Chapter 1). The key issues in the hierarchy have been adopted nearly verbatim from the key issues in the Mission Plan and thus they are derived directly from the system guidelines in 10 CFR Part 960. The issues defined for each key issue in the hierarchy, taken together, are identical in overall scope to the issues in the Mission Plan, but the structure and specific wording of the issues are different. The issues under each key issue are grouped into three categories: performance issues, design issues, and characterization issues, to reflect the structure and intent of the primary governing regulations contained in 10 CFR Part 60 and 10 CFR Part 960. 10 CFR Part 60 clearly makes a distinction between performance objectives and design criteria, which although obviously related, have a different objective and must be addressed from different perspectives. A third perspective is represented by the focus of 10 CFR Part 960 on the characteristics of the site. The three categories of issues are summarized as follows:

Performance issues generally address questions regarding compliance with regulatory requirements that are related to the performance of the mined geologic disposal system. They generally relate directly to the highest level of regulatory requirements to be satisfied or findings that must be made. For example, there are performance issues that correspond to each of the postclosure performance objectives set forth in 10 CFR 60.112. Performance issues identify the information related to design, site characteristics, and performance assessments needed to address the regulatory requirements. Information about performance assessments is addressed directly by the performance issues; information about design and site characteristics is addressed by the design and characterization issues, respectively.

Design issues address needs for information about the design of the repository, seals, and the waste package. Design issues may address design criteria specified in 10 CFR 60.130 through 60.134, preclosure system and technical guidelines in 10 CFR 960.5-1 and 960.5-2, and/or information required to support resolution of the performance issues. Design issues also identify information about site characteristics that is needed for design purposes.

Characterization issues are intended to encompass the site characteristics, processes, and events that may affect repository design and performance. These issues address the detailed information on site characteristics that will be used to develop site descriptions and support resolution of related design and performance issues, including the information needed to determine compliance with the guidelines of 10 CFR Part 960 in support of site selection.

The relationships among the three categories of issues are illustrated in Figure 1. The performance and design issues provide requirements (priorities) for the characterization issues. Resolution of the characterization issues results in data for the analyses needed to address design and performance issues. An activity related to an information need under a characterization issue will only take place if that activity is necessary to provide data to resolve an identified design or performance question or to satisfy information requirements from 10 CFR Part 960. The characterization issues provide a discipline-oriented control to facilitate preparation of descriptions of site characteristics. This early integrating effort will ensure that site aspects related to diverse design and performance topics will be adequately addressed in discipline-oriented topical reports.

The wording of each issue in the hierarchy was chosen to reflect the identified interrelationships among the three categories of issues and, where practical, to explicitly tie the issue to its associated regulatory requirement(s) by providing a citation to the applicable regulation(s). Although the key issues and issues are intended to convey precisely the same meaning as the regulations, in some cases the terms used in an issue are not the same as the terms used by the regulations. These differences reflect differences between the definitions of terms used in various regulations and the definitions that the DOE has chosen to adopt in "Generic Requirements for a Mined Geologic Disposal System," OGR/B-2 (the GR). The issues hierarchy in Section 3 uses terms from this baselined DOE document.

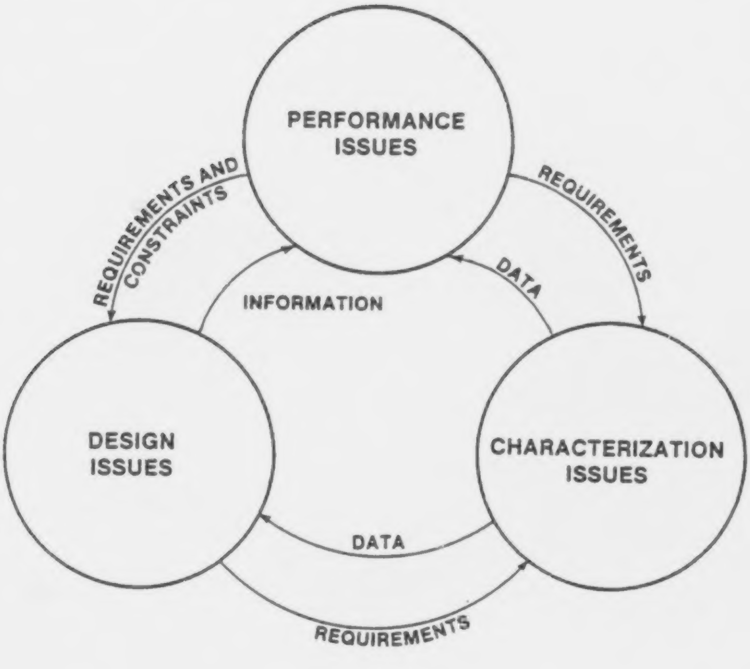
PERFORMANCE ISSUES
DESIGN ISSUES
CHARACTERIZATION ISSUES
REQUIREMENTS AND CONSTRAINTS
REQUIREMENTS
INFORMATION
DATA
DATA
REQUIREMENTS

Figure 1. Relationships among the three categories of issues in the OGR

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3. ISSUES HIERARCHY

KEY ISSUE 1: Will the mined geologic disposal system at [site name] isolate the radioactive waste from the accessible environment after closure in accordance with the requirements set forth in 40 CFR Part 191, 10 CFR Part 60, and 10 CFR Part 960?

PERFORMANCE ISSUES

ISSUE 1.1: Will the mined geologic disposal system meet the system performance objective for limiting radionuclide releases to the accessible environment as required by 10 CFR 60.112 and 40 CFR 191.13?

ISSUE 1.2: Will the mined geologic disposal system meet the requirements for limiting individual doses in the accessible environment as required by 40 CFR 191.15?

ISSUE 1.3: Will the mined geologic disposal system meet the requirements for the protection of special sources of ground water as required by 40 CFR 191.16?

ISSUE 1.4: Will the waste package meet the performance objective for containment as required by 10 CFR 60.113?

ISSUE 1.5: Will the waste package and repository engineered barrier systems meet the performance objective for radionuclide release rates as required by 10 CFR 60.113?

ISSUE 1.6: Will the site meet the performance objective for pre-waste-emplacement ground-water travel time as required by 10 CFR 60.113?

ISSUE 1.7: Will the performance-confirmation program meet the requirements of 10 CFR 60.137?

ISSUE 1.8: Can the demonstrations for favorable and potentially adverse conditions be made as required by 10 CFR 60.122?

ISSUE 1.9: (a) Can the higher-level findings required by 10 CFR Part 960 be made for the qualifying condition of the postclosure system guideline and the disqualifying and qualifying conditions of the technical guidelines for geohydrology, geochemistry, rock characteristics, climate changes, erosion, dissolution, tectonics, and human interference; and (b) can the comparative evaluations required by 10 CFR 960.3-1-5 be made?

DESIGN ISSUES

ISSUE 1.10: Have the characteristics and configurations of the waste packages been adequately established to (a) show compliance with the postclosure design criteria of 10 CFR 60.135 and (b) provide information for the resolution of the performance issues?

ISSUE 1.11: Have the characteristics and configurations of the repository and the repository engineered barriers been adequately established to (a) show compliance with the postclosure design criteria of 10 CFR 60.133 and (b) provide information for the resolution of the performance issues?

ISSUE 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established to (a) show compliance with the postclosure design criteria of 10 CFR 60.134 and (b) provide information for the resolution of the performance issues?

CHARACTERIZATION ISSUES

ISSUE 1.13: Do the data collected in order to describe the present and expected geohydrologic characteristics provide the information required by the design and performance issues?

ISSUE 1.14: Do the data collected in order to describe the present and expected geochemical characteristics provide the information required by the design and performance issues?

ISSUE 1.15: Do the data collected in order to describe the present and expected rock characteristics provide the information required by the design and performance issues?

ISSUE 1.16: Do the data collected in order to describe the future climatic conditions provide the information required by the design and performance issues?

ISSUE 1.17: Do the data collected in order to describe the future erosional processes and rates provide the information required by the design and performance issues?

ISSUE 1.18: Do the data collected in order to describe rock dissolution provide the information required by the design and performance issues?

ISSUE 1.19: Do the data collected in order to describe future tectonic processes or events provide the information required by the design and performance issues?

ISSUE 1.20: Do the data collected in order to describe the potential for future disruptive human activities at or near the site provide the information required by the design and performance issues?

KEY ISSUE 2: Will the projected releases of radioactive materials to restricted and unrestricted areas and the resulting radiation exposures of the general public and workers during repository operation, closure and decommissioning at [site name], meet applicable safety requirements set forth in 10 CFR Part 20, 10 CFR Part 60, 10 CFR Part 960, and 40 CFR Part 191?

PERFORMANCE ISSUES

ISSUE 2.1: During repository operation, closure, and decommissioning (a) will the expected average radiation dose received by members of the public within any highly populated area be less than a small fraction of the allowable limits and (b) will the expected radiation dose received by any member of the public in an unrestricted area be less than the allowable limits as required by 10 CFR 60.111, 40 CFR 191 Part A, and 10 CFR Part 20?

ISSUE 2.2: Can the repository be designed, constructed, operated, closed, and decommissioned in a manner that ensures the radiological safety of workers under normal operations as required by 10 CFR 60.111 and CFR Part 20?

ISSUE 2.3: Can the repository be designed, constructed, operated, closed, and decommissioned in such a way that credible accidents do not result in projected radiological exposures of the general public at the nearest boundary of the unrestricted area, or workers in the restricted area, in excess of applicable limiting values?

ISSUE 2.4: Can the repository be designed, constructed, operated, closed, and decommissioned so that the option of waste retrieval will be preserved as required by 10 CFR 60.111?

ISSUE 2.5: Can the higher level findings required by 10 CFR Part 960 be made for the qualifying condition of the preclosure system guideline and the disqualifying and qualifying conditions of the technical guidelihes for population density and distribution, site ownership and control, meteorology, and offsite installations and operations?

DESIGN ISSUES

ISSUE 2.6: Have the characteristics and configurations of the waste packages been adequately established to (a) show compliance with the preclosure design criteria of 10 CFR 60.135 and (b) provide information for the resolution of the performance issues?

ISSUE 2.7: Have the characteristics and configurations of the repository been adequately established to (a) show compliance with the preclosure design criteria of 10 CFR 60.130 through 60.133 and (b) provide information for the resolution of the performance issues?

CHARACTERIZATION ISSUES

ISSUE 2.8: Do the data collected on population density and distribution provide the information required by the design and performance issues?

ISSUE 2.9: Do the data collected on the status of land ownership and surface and subsurface rights to land and minerals provide the information required by the design and performance issues?

ISSUE 2.10: Do the data collected on meteorological conditions provide the information required by the design and performance issues?

ISSUE 2.11: Do the data collected on offsite installations and operations provide the information required by the design and performance issues?

KEY ISSUE 3: Can the mined geologic disposal system at [site name] be sited, constructed, operated, closed, and decommissioned, and can the associated transportation system be sited, constructed, and operated so that the quality of the environment will be protected and waste-transportation operations can be conducted without causing unacceptable risks to public health or safety?

Note: The issues under Key Issue 3 will be identified after the EIS scoping hearings. The issues hierarchy will be amended at that time.

KEY ISSUE 4: Will the construction, operation (including retrieval), closure, and decommissioning of the mined geological disposal system be feasible at [site name] on the basis of reasonably available technology, and will the associated costs be reasonable in accordance with the requirements set forth in 10 CFR Part 960?

PERFORMANCE ISSUES

ISSUE 4.1: Can the higher-level findings required by 10 CFR Part 960 be made for the qualifying condition of the preclosure system guideline and the disqualifying and qualifying conditions of the technical guidelines for surface characteristics, rock characteristics, hydrology, and tectonics?

DESIGN ISSUES

ISSUE 4.2: Are the repository design and operating procedures developed to ensure non-radiological health and safety of workers adequately established for the resolution of the performance issues?

ISSUE 4.3: Are the waste package production technologies adequately established for the resolution of the performance issues?

ISSUE 4.4: Are the technologies of repository construction, operation, closure and decommissioning adequately established for the resolution of the performance issues?

ISSUE 4.5: Are the costs of the waste packages and the repository adequately established for the resolution of the performance issues?

CHARACTERIZATION ISSUES

ISSUE 4.6: Do the data collected in order to describe the surface characteristics and conditions provide the information required by the performance and design issues?

ISSUE 4.7: Do the data collected in order to describe the rock characteristics provide the information required by the performance and design issues?

ISSUE 4.8: Do the data collected in order to describe the hydrologic characteristics and conditions provide the information required by the performance and design issues?

ISSUE 4.9: Do the data collected in order to describe the expected tectonic phenomena and igneous activity provide the information required by the performance and design issues?

4. BASIS FOR WORDING OF ISSUES

Regardless of the regulatory source of the issue, the wording of the issues presented in Section 3 was chosen to make the terminology consistent with that used in the GR to describe the components of the pre- and postclosure MGDS. Additional clarification regarding the rationale for the wording of specific issues is presented in this section on a case-by-case basis. Citations to applicable regulations are abbreviated as follows:

Regulation	Abbreviation
10 CFR Part 60	Part 60
Sections of Part 60	60.x
10 CFR Part 960	Part 960
Sections of Part 960	960.x
40 CFR Part 191	Part 191
Sections of Part 191	191.x

KEY ISSUE 1:

Key Issue 1 of the Mission Plan (DOE/RW-0005), revised to identify the site and include a citation to the postclosure requirements of Part 960; Key Issue 1 of the Mission Plan is derived directly from the postclosure system guideline of 960.4-1, which defines the general long-term performance requirements for the MGDS; the requirements of 960.4-1 are based on the Technical Criteria of Part 60 Subpart E and the Environmental Standards of Part 191 Subpart B.

PERFORMANCE ISSUES

ISSUE 1.1:

Overall system performance objective of 60.112 requiring conformance with applicable EPA standards for radionuclide releases to the accessible environment following permanent closure; the requirements of Part 191 Subpart B of the final EPA standard are incorporated by inference; the containment requirements of 191.13 were the only applicable EPA standard for postclosure releases at the time 60.112 was written; future NRC rulemaking will conform Part 60 to specifically include the requirements of 191.13.

ISSUE 1.2:

Individual protection requirements of 191.15; as presently written, the overall system performance objective of 60.112 requires conformance with applicable EPA standards for postclosure releases to the accessible environment and therefore incorporates the requirements of Part 191 Subpart B of the final EPA standard by inference; future NRC rulemaking will conform Part 60 to specifically include the requirements of 191.15.

ISSUE 1.3:

Ground water protection requirements of 191.16; as presently written, the overall system performance objective of 60.112 requires conformance with applicable EPA standards for postclosure releases to the accessible environment and therefore incorporates the requirements of Part 191 Subpart B of the final EPA standard by inference; future NRC rulemaking will conform Part 60 to specifically include the requirements of 191.16.

ISSUE 1.4:

Performance objective for waste package containment from 60.113.

ISSUE 1.5:

Performance objective for engineered barrier system (NRC terminology) from 60.113, with the terminology revised to be consistent with the GR and indicate that the postclosure barriers of the MGDS being considered are the waste package and the repository engineered barriers.

ISSUE 1.6:

Performance objective for the geologic setting (NRC terminology), with respect to pre-waste-emplacement groundwater travel time, from 60.113.

ISSUE 1.7:

Technical criteria from 60.137, linking design to implementation of the performance confirmation program required by Part 60 Subpart F; although the performance confirmation program is conducted during the preclosure period, this issue is included under Key Issue 1 because it is required to provide assurance regarding postclosure performance.

ISSUE 1.8:

Identifies need to address siting criteria of 60.122.

ISSUE 1.9:

Higher-level findings, as required by Part 960, Appendix III, with respect to the postclosure guidelines of Part 960 Subpart C; and comparative evaluations of alternative sites based on these postclosure guidelines, as required by 960.3-2-4 according to the basis for such evaluations as specified in 960.3-1-5.

DESIGN ISSUES

ISSUE 1.10:

Identifies need to address postclosure design criteria of 60.135 for the waste package and provide information to support resolution of related performance issues.

ISSUE 1.11:

Identifies need to address postclosure design criteria of 60.133 for the underground facility (NRC terminology), now identified as the repository and repository engineered barriers to be consistent with the GR, and provide information to support resolution of related performance issues.

ISSUE 1.12:

Identifies need to address postclosure design criteria of 60.134 for shaft and borehole seals, and provide information to support resolution of related performance issues.

CHARACTERIZATION ISSUES

ISSUES 1.13 through 1.20:

All issues identify the need to collect sufficient data under each category to adequately describe the present and expected characteristics of the site, and provide the information on site characteristics needed to support resolution of postclosure design and performance issues; the information categories listed are the same as those used to structure the postclosure technical guidelines of Part 960 Subpart C.

KEY ISSUE 2:

Key Issue 2 of the Mission Plan (DOE/RW-0005), revised to identify the site and include a citation to the preclosure requirements of Part 960; Key Issue 2 of the Mission Plan is derived from the preclosure system guideline of 960.5-1 (a)(1), which requires compliance with the applicable radiological safety requirements of Part 20, Part 60 Subpart E, and the Environmental Standards of Part 191 Subpart A.

PERFORMANCE ISSUES

ISSUE 2.1:

Issue 2.1 of the Mission Plan, which is derived from the preclosure technical guideline of 960.5-2-1, with citations to the applicable preclosure radiological safety requirements for members of the public in unrestricted areas from 60.111, Part 20, and Part 191 Subpart A.

ISSUE 2.2:

Preclosure radiological safety requirements for workers with citations to applicable regulatory requirements of 60.111 and Part 20.

ISSUE 2.3:

Identifies need to address preclosure accident releases; no regulatory citation is given as the NRC has not undertaken rulemaking to define the allowable accident releases during preclosure.

ISSUE 2.4:

Identifies need to ensure retrievability as required by 10 CFR 60.111.

ISSUE 2.5:

Higher-level findings, as required by Part 960 Appendix III, with respect to the preclosure guidelines of Part 960 Subpart D, for preclosure radiological safety; and comparative evaluations of alternative sites based on these preclosure guidelines, as required by 960.3-2-4 according to the basis for such evaluations as specified in 960.3-1-5.

DESIGN ISSUES

ISSUE 2.6:

Identifies need to address preclosure design criteria of 60.135 for the waste package and provide information to support resolution of related performance issues.

ISSUE 2.7:

Identifies need to address preclosure design criteria of 60.131 through 60.133 for the preclosure repository system and operations, and provide information to support resolution of related performance issues.

CHARACTERIZATION ISSUES

ISSUES 2.8 through 2.11:

All issues identify the need to collect sufficient data under each category to provide the information needed to support resolution of preclosure design and performance issues; the information categories listed are the same as those used to structure the preclosure technical guidelines for preclosure radiological safety from Part 960 Subpart D.

KEY ISSUE 3:

Key Issue 3 of the Mission Plan (DOE/RW-0005), revised to identify the site and incorporate the term mined geologic disposal system as used in the GRD; the waste transportation system is identified separately from the MGDS; Key Issue 3 is derived from the preclosure system guideline in 960.5-1 (a) (2) for environment, socioeconomics, and transportation.

KEY ISSUE 4:

Key Issue 4 of the Mission Plan (DOE/RW-0005), revised to identify the site and include a citation to the preclosure requirements of Part 960, and to include specific mention of retrieval and decommissioning with respect to determination of feasibility and cost; Key Issue 4 of the Mission Plan is derived directly from the preclosure system guideline of 960.5-1 (a) (3).

PERFORMANCE ISSUES

ISSUE 4.1:

Higher-level findings, as required by Part 960 Appendix III, with respect to the preclosure guidelines of Part 960 Subpart D, for ease and cost of siting, construction, operation, and closure, and comparative evaluations of alternative sites based on these preclosure guidelines, as required by 960.3-2-4 according to the basis for such evaluations as specified in 960.3-1-5.

DESIGN ISSUES

ISSUE 4.2:

Identifies the need to adequately characterize the nature and feasibility of the repository design and associated operating procedures needed to ensure the non-radiological health and safety of the workers in order to support resolution of the related performance issue.

ISSUE 4.3:

Identifies the need to adequately characterize the nature and availability of the technology to be used for waste package fabrication in order to support resolution of the related performance issue.

ISSUE 4.4:

Identifies the need to adequately characterize the nature and feasibility of the technology to be used during repository construction, operation, closure, and decommissioning, in order to support resolution of the related performance issue.

ISSUE 4.5:

Identifies the need to adequately characterize the costs associated with waste package fabrication and repository construction, operation, closure, and decommissioning, in order to support resolution of the related performance issue.

CHARACTERIZATION ISSUES

ISSUES 4.6 through 4.9:

Identify the need to collect sufficient data under each category to describe the characteristics of the site that affect the feasibility and cost of MGDS-related activities and to provide the information needed to support resolution of preclosure design and performance issues; the information categories listed are the same as those used to structure the preclosure technical guidelines for ease and cost of construction from Part 960 Subpart D.

5. CORRELATION OF ISSUES WITH REGULATORY REQUIREMENTS

This issues hierarchy provides a unified, comprehensive framework for representing the regulatory requirements that must be satisfied to site and license a mined geologic disposal system. The connection between the issues and the regulatory requirements was described in general terms in the rationale for the wording of individual issues, as presented in Section 4. Figures 2 through 4 provide a graphical correlation between each of the issues and specific regulatory requirements from 10 CFR Part 960, 10 CFR Part 60, 40 CFR Part 191, and 10 CFR Part 20.

The matrices indicate (with a solid circle), for each specific regulatory requirement, the performance or design issue(s) that, when resolved, will satisfy that regulatory requirement. The matrices also indicate (with an open circle), for each regulatory requirement, the characterization issues that, when resolved, will provide the principal source of information on site characteristics needed to support resolution of the design and performance issues in addressing the identified regulatory requirement. Although there are numerous secondary interrelationships and support requirements among the issues that are not indicated on the matrices, these interrelationships will be identified and accounted for in the approach to issue resolution and performance allocation described in Section 6.

KEY ISSUE 1

Postclosure performance.

	ISSUES REGULATIONS	PERFORMANCE									DESIGN			CHARACTERIZATION							
		1.1 RELEASES TO ACCESSIBLE ENVIRONMENT	1.2 INDIVIDUAL PROTECTION	1.3 GROUND-WATER PROTECTION	1.4 WASTE PACKAGE CONTAINMENT	1.5 RELEASE RATE	1.6 GROUND-WATER TRAVEL TIME	1.7 PERFORMANCE CONFIRMATION	1.8 NRC SITING CRITERIA	1.9 DOE GUIDELINE FINDINGS	1.10 WASTE PACKAGE	1.11 REPOSITORY	1.12 SEALS	1.13 GEOHYDROLOGY	1.14 GEOCHEMISTRY	1.15 ROCK CHARACTERISTICS	1.16 CLIMATIC CONDITIONS	1.17 EROSION	1.18 DISSOLUTION	1.19 TECTONICS	1.20 FUTURE HUMAN ACTIVITIES
10 CFR 960	960.3-1-5 SITE EVALUATIONS									●											
	960.4-1 POSTCLOSURE SYSTEM									●											
	960.4-2-1 GEOHYDROLOGY									●				○							
	960.4-2-2 GEOCHEMISTRY									●					○						
	960.4-2-3 ROCK CHARACTERISTICS									●						○					
	960.4-2-4 CLIMATIC CHANGES									●							○				
	960.4-2-5 EROSION									●								○			
	960.4-2-6 DISSOLUTION									●									○		
	960.4-2-7 TECTONICS									●										○	
	960.4-2-8 HUMAN INTERFERENCE									●											○
10 CFR 60	60.112 SYSTEM PERFORMANCE OBJECTIVE	●																			
	60.113 SUBSYSTEM PERFORMANCE OBJECTIVES				●	●	●														
	60.122 SITING CRITERIA								●												
	60.133 UNDERGROUND FACILITY DESIGN CRITERIA											●									
	60.134 SEAL DESIGN CRITERIA												●								
	60.135 WASTE PACKAGE DESIGN CRITERIA										●										
	60.137 PERFORMANCE CONFIRMATION REQUIREMENTS							●													
40 CFR 191	191.13 CONTAINMENT REQUIREMENTS	●																			
	191.15 INDIVIDUAL PROTECTION REQUIREMENTS		●																		
	191.16 GROUND-WATER PROTECTION REQUIREMENTS			●																	

OTES:

1. THE SYMBOL ● MEANS THAT RESOLUTION OF THE INDICATED ISSUE(S) WILL SATISFY THE INDICATED REGULATORY REQUIREMENT
2. THE SYMBOL ○ MEANS THAT THE INDICATED ISSUE IS ONE OF THE PRINCIPAL ISSUES THAT NEED TO BE RESOLVED TO SATISFY THE INDICATED REGULATORY REQUIREMENT
3. ALTHOUGH NOT SHOWN, MANY OF THE DESIGN AND CHARACTERIZATION ISSUES CONTRIBUTE TO SATISFYING EACH OF THE REGULATORY REQUIREMENTS

Figure 2. Correlation of issues to regulations for Key Issue 1.

KEY ISSUE 2

Preclosure radiological safety.

		PERFORMANCE					DESIGN		CHARACTERIZATION			
	REGULATIONS / ISSUES	2.1 PUBLIC SAFETY DURING NORMAL OPERATION	2.2 WORKER SAFETY	2.3 PUBLIC SAFETY DURING ACCIDENTS	2.4 RETRIEVABILITY	2.5 DOE GUIDELINE FINDINGS	2.6 WASTE PACKAGE DESIGN	2.7 REPOSITORY DESIGN	2.8 POPULATION	2.9 LAND OWNERSHIP	2.10 METEOROLOGY	2.11 OFFSITE FACILITIES
10 CFR 960	960.5-1 PRECLOSURE SYSTEM — RADIOLOGICAL SAFETY					●						
	960.5-2-1 POPULATION					●			○			
	960.5-2-2 SITE OWNERSHIP					●				○		
	960.5-2-3 METEOROLOGY					●					○	
	960.5-2-4 OFFSITE INSTALLATIONS					●						○
10 CFR 60	60.111 RADIOLOGICAL PROTECTION AND RETRIEVABILITY	●	●	●	●							
	60.131 GENERAL DESIGN CRITERIA							●				
	60.133 UNDERGROUND FACILITY DESIGN CRITERIA							●				
	60.135 WASTE PACKAGE DESIGN CRITERIA						●					
	40 CFR Subpart A STANDARDS FOR MANAGEMENT	●										
	10 CFR 20 RADIATION PROTECTION STANDARDS	●	●									

NOTES:

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Figure 3. Correlation of issues to regulations for Key Issue 2. 0217-0031RJ 6/25/86

KEY ISSUE 4

Ease and cost of development.

	REGULATIONS / ISSUE	PERFORMANCE	DESIGN				CHARACTERIZATION			
		4.1 GUIDELINE FINDINGS	4.2 NON-RADIOLOGICAL WORKER SAFETY	4.3 WASTE PACKAGE PRODUCTION	4.4 ADEQUACY OF TECHNOLOGY	4.5 COSTS	4.6 SURFACE CHARACTERISTICS	4.7 ROCK CHARACTERISTICS	4.8 HYDROLOGY	4.9 TECTONICS
10 CFR 960	960.5-1 PRECLOSURE SYSTEM — EASE AND COST	●	●	●	●	●				
	960.5-2-8 SURFACE CHARACTERISTICS	●			●	●	○			
	960.5-2-9 ROCK CHARACTERISTICS	●			●	●		○		
	960.5-2-10 HYDROLOGY	●			●	●			○	
	960.5-2-11 TECTONICS	●			●	●				○

NOTES:

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Figure 4. Correlation of issues to regulations for Key Issue 4.

6. ISSUE RESOLUTION STRATEGY AND PERFORMANCE ALLOCATION PROCESS

The OGR issues hierarchy provides a common framework to be used by all DOE Project Offices in planning and conducting site characterization activities supporting site selection and licensing. The rationale for systematic resolution of the issues in this hierarchy is presented in a generic "issue resolution strategy" developed and agreed to by Headquarters and the Project Offices. Since the issues are derived from the applicable regulations, identification of the information needed to resolve these issues facilitates identification and planning of the work that needs to be done to demonstrate compliance with the regulatory requirements. The issue resolution strategy provides a step-wise procedure for identifying and planning the work needed to support resolution of the issues.

General Application

The issue resolution strategy includes up to twelve separate steps, depending on the type of issue, as shown in Figure 5, and includes the concept of performance allocation. The overall strategy is based on identification of regulatory requirements (step 1) and the preparation of a formal description of a proposed mined geologic disposal system (step 1a). This information is used to define the issues in the issues hierarchy (step 2). Next, a "licensing strategy" (step 3) is developed for each individual issue, which determines how the components of the repository system will be relied on during licensing to demonstrate compliance with the regulatory requirements. Using the information available at the time the strategy is being developed (or revised), a statement identifying the site features, engineered features, conceptual models, and analyses that are expected to be relied upon in resolving the issue is developed for planning purposes. This statement, relating to the strategy for resolution of a single issue, is called a "licensing strategy," because when combined with the strategies developed for all other issues, it establishes the basis for the plans to be followed in demonstrating compliance with regulatory requirements, eventually supporting the DOE's selection of a site for development of a repository and the NRC's requirements for approving construction, operation, closure, and license termination for a repository. In the initial stages of characterization of sites, this plan will necessarily be based on preliminary definition of licensing strategies. These strategies will guide the development of the programs for testing and analysis, however, and will help to make clear what tests and analyses are necessary to support resolution of the issues. As the characterization of candidate sites proceeds and better information becomes available, the licensing strategies will be refined, as needed, to better support the site selection and licensing requirements.

The licensing strategy step and the next three steps define the "performance allocation" process. Performance allocation entails deciding which system elements will be relied upon in resolving an issue, identifying the functions that the elements will be expected to perform and the processes that will affect the performance of each element, identifying and assigning specific quantitative goals to measures and parameters that represent the expected performance, and developing a testing program to obtain the information relevant to the identified parameters. Development of a licensing strategy (Step 3 of Figure 6) is the first step in the performance allocation

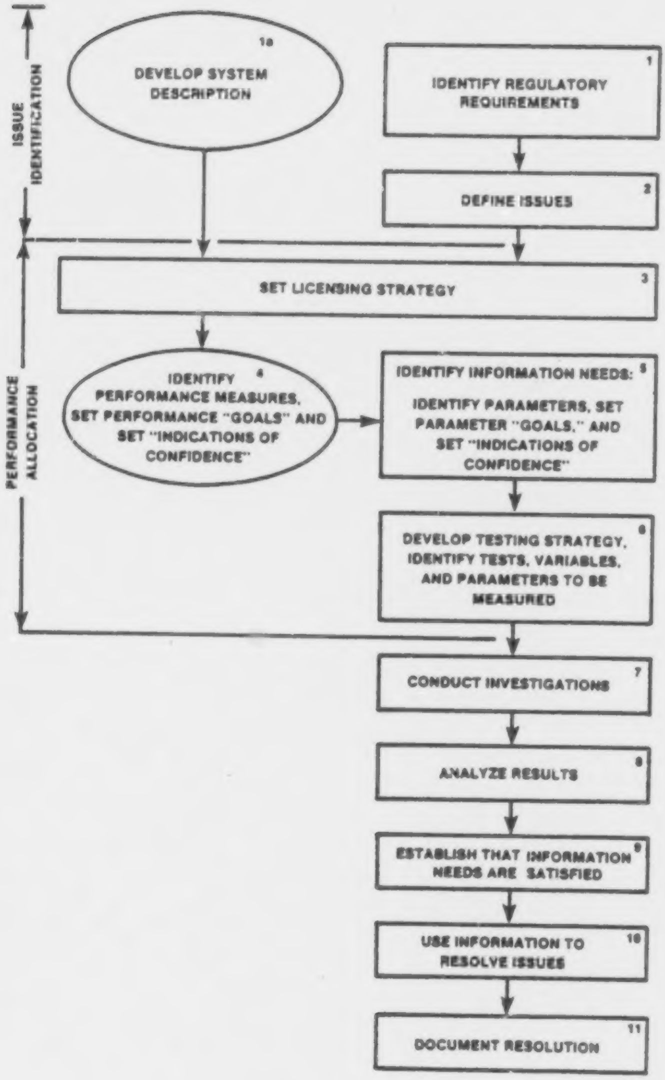

ISSUE IDENTIFICATION
1a
DEVELOP SYSTEM DESCRIPTION
1
IDENTIFY REGULATORY REQUIREMENTS
2
DEFINE ISSUES
3
SET LICENSING STRATEGY
PERFORMANCE ALLOCATION
4
IDENTIFY PERFORMANCE MEASURES, SET PERFORMANCE "GOALS" AND SET "INDICATIONS OF CONFIDENCE"
5
IDENTIFY INFORMATION NEEDS:
IDENTIFY PARAMETERS, SET PARAMETER "GOALS," AND SET "INDICATIONS OF CONFIDENCE"
6
DEVELOP TESTING STRATEGY, IDENTIFY TESTS, VARIABLES, AND PARAMETERS TO BE MEASURED
7
CONDUCT INVESTIGATIONS
8
ANALYZE RESULTS
9
ESTABLISH THAT INFORMATION NEEDS ARE SATISFIED
10
USE INFORMATION TO RESOLVE ISSUES
11
DOCUMENT RESOLUTION

Figure 5. Issue resolution strategy.

0217-86319C 6/30/86

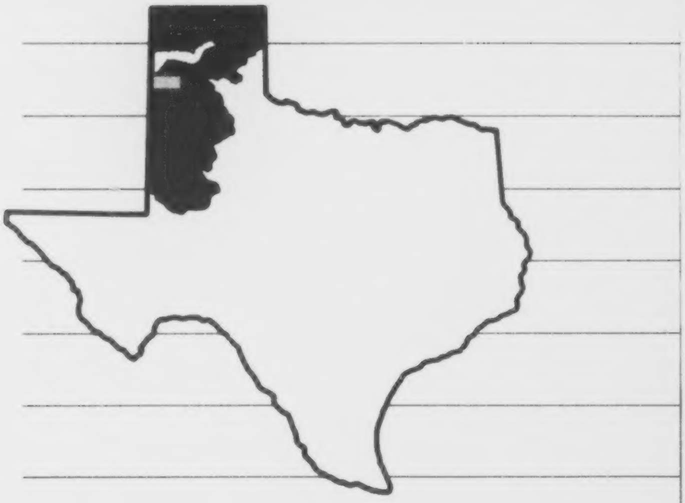
process. Steps 4 through 6 can be described as expressing the licensing strategy in certain specifically defined terms, and using those expressions to continue the development of information needs for each issue in the hierarchy and to derive an explicit, detailed statement of the strategy and objectives of the test program needed to support resolution of the issue. The tests themselves are defined in step 6 once the information and parameter needs have been identified for all issues and consolidated into non-redundant lists of the requirements for each area of testing or analysis. Steps 4 through 6 may be iterative in that identification of the requirements for one step may reveal a need for changes in a preceeding step, or even in the licensing strategy.

After the performance allocation process has been completed, the following steps include the conduct of the investigations (step 7) and performance of the analyses and evaluations needed to support issue resolution (Step 8). In step 9 the results of the investigations and analyses are used to establish whether the information needs have been satisfied. Once this determination has been made, the information is employed to demonstrate issue resolution (step 10) and the resolution process is documented (step 11).

*U.S. GOVERNMENT PRINTING OFFICE: 1986-491-175:40125

Managing the Nation's Nuclear Waste

Questions & Answers About the Potential Effects of a Repository on the Ogallala Aquifer



United States Department of Energy

Office of Civilian Radioactive Waste Management

Questions and Answers About the Potential Effects of a Repository on the Ogallala Aquifer in Texas

The U.S. Department of Energy (DOE) recognizes that protection of the Ogallala aquifer is a serious concern because of its importance as the primary water source for people and for irrigation in the Deaf Smith agricultural region. The objectives of the Civilian Radioactive Waste Management Program are to isolate nuclear waste and to protect the public's health and safety within standards and regulations set by the U.S. Environmental Protection Agency and U.S. Nuclear Regulatory Commission.

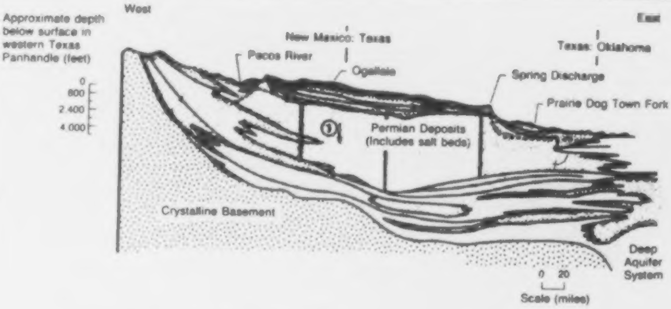
The Office of Civilian Radioactive Waste Management is using a step-by-step site selection process to evaluate geologic and hydrologic characteristics of the potential sites to help assure that nuclear waste will not escape from the repository, move through the host rock, and subsequently be released into the human environment. The locations now being studied as potential sites, including those in Deaf Smith County, are being examined in part because rock formations at the potential repository depth are of very low permeability, meaning that water does not move through the formations very easily, if at all. Where movement does occur, the rate is extremely low. Aquifer tests will continue to be performed and water samples collected to determine the physical and chemical characteristics of the Ogallala aquifer.

Could the Ogallala aquifer become contaminated by nuclear waste from the repository?

The repository system itself is being designed and would be operated to prevent contamination of surface water or ground water. The waste brought to a repository would be in solid form and in heavily shielded casks. Waste packages would be emplaced about 2,500 feet below the surface in a stable salt formation that must meet pre-established siting guidelines. The guidelines include geologic characteristics such as rock strength and very low permeability. Isolation and containment of nuclear waste would be assured through barriers—both natural and engineered—between the waste and the human environment.

- **Geologic barriers** include the rock formation in which the repository is located as well as the surrounding geologic formations.

- **Engineered barriers** include an insoluble waste form, a corrosion-resistant metal canister, repository backfill, and shaft seals.


Approximate depth below surface in western Texas Panhandle (feet)
0
800
2,400
4,000
West
East
New Mexico: Texas
Texas: Oklahoma
Pecos River
Ogallala
Spring Discharge
Prairie Dog Town Fork
①
Permian Deposits (Includes salt beds)
Crystalline Basement
Deep Aquifer System
0 20
Scale (miles)

Could the Repository Contaminate the Ogallala Aquifer?

- If a well or fracture penetrated from the Ogallala through the repository level, radioactive material would remain stationary or travel downwards ① because of pressure differences between the Ogallala and deeper aquifers.
- The total ground-water travel time from the repository to the accessible environment is estimated to be in the range of 310,000 to 370,000 years.

Ground-Water Travel in Texas Panhandle

Even if the waste could escape these barriers, its travel time to the accessible environment has been calculated to be so long that the waste's radioactivity will have decayed to regulated levels. The Ogallala aquifer is approximately 2,000 feet above the depth of a repository and the Dockum (Santa Rosa) aquifer is more than 1,000 feet above it.

Generally, studies show that the pressure of the aquifers* decreases with depth. This creates the potential for ground water to flow down to the deeper saline (brine) aquifers, rather than up towards the Ogallala and Dockum (Santa Rosa) aquifers. These deep, saline aquifers are about 4,500 feet below the Ogallala. Once in those deep aquifers, any radioactive materials that might be released would be isolated for very long times due to extremely slow movement of the ground water. The total ground-water travel time from the repository to the accessible environment is estimated to be in the range of 310,000 to 370,000 years.

There are no known fractures that connect the Ogallala aquifer and the layer of salt where a repository could be located. The rock formation at the repository depth and the formations immediately above and below it consist of rock that has very low permeability and has very little water in it.

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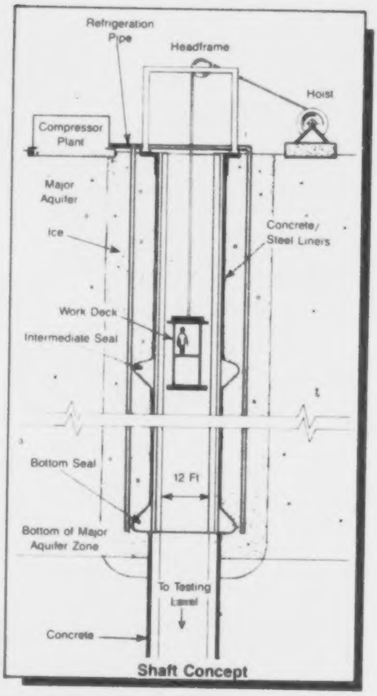
*The aquifers include freshwater aquifers near the surface, such as the Ogallala and the Dockum group (which includes the Santa Rosa aquifer) and deep saline aquifers, such as the Wolfcamp which is 3,000 feet below the proposed repository horizon.

The repository would be required to meet U.S. Environmental Protection Agency (EPA) standards and U.S. Nuclear Regulatory Commission (NRC) regulations, including those requiring long-term waste containment. The EPA's standards* limit release of radioactive material to the environment for 10,000 years after disposal. This time period was selected in part because it is long enough for radionuclides released into ground water to decay to regulated levels of very low radioactivity before reaching the accessible environment. Choosing 10,000 years for containment requires selection of sites where properties of the rock can significantly reduce the release of radioactivity to the accessible environment.

The NRC regulations** specify that the waste package must contain the high-level waste during the period when most of the radioactivity and heat are being emitted (300 to 1,000 years). The regulations also state that, at the site selected, the ground-water travel time along the fastest path of likely radionuclide travel from the repository to the accessible environment must be at least 1,000 years. Meeting these two requirements along with all of the natural barriers—such as the host rock itself—provides a much longer period of isolation for the waste to ensure the safety of the site and protection of the Ogallala and Dockum aquifers.

2 What are exploratory shafts and will they be designed and sealed to prevent water from leaking downwards?

The exploratory shafts are two shafts approximately 12 feet in diameter that would be constructed to the depth of the potential repository. The purpose of the exploratory shafts is to allow geologic and engineering studies to be conducted at repository depth. One shaft will provide access for workers and supplies. A second shaft will be used for the removal of excavated materials and as an emergency exit for workers.



Shaft Concept

The exploratory shafts will be constructed before a final repository site decision is made to examine the geologic conditions at a potential site to determine its suitability or unsuitability as a repository (site characterization). Although the final designs for the exploratory shafts are not yet established, the exploratory shafts could look like the concept shown on this page. The shafts would be constructed using conventional mining methods.

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*U.S. Environmental Protection Agency, "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," Title 40, *Code of Federal Regulations*, Part 191, September 19, 1985.

**Nuclear Regulatory Commission, "Disposal of High-Level Radioactive Wastes in Geologic Repositories: Technical Criteria," 10 *Code of Federal Regulations*, Part 60, June, 1983.

A major concern in Texas is that construction of the shafts, which will pass through the Ogallala and Dockum aquifers, will lower the water table or contaminate the water supply. Many such shafts have been constructed through highly permeable formations similar to the Ogallala and Dockum without disturbance of the aquifers. For example, a successful shaft installation through a permeable water-bearing formation has been reported from Britain at the Selby coal field. Ground-freezing techniques were used at the Selby coal field similar to the methods planned for the Deaf Smith site. Other such shafts have been constructed in Europe, Canada, Arizona, Louisiana, Pennsylvania, New Mexico, and Texas.

The shafts will be constructed based on the detailed site information obtained from an engineering design borehole. To stabilize surrounding strata and control ground water for shaft construction at the Texas site, the following ground-freezing technique will be used. First, a series of boreholes is drilled in a circular pattern 15 to 20 feet from the shaft center for coolant circulation pipes. The pipes are connected to a surface refrigeration plant. Coolant is circulated continuously through the pipes and the ground is frozen to form a cylindrical ice column around the shaft. The ground is frozen to below the lowest aquifer, a depth of 1,100 to 1,200 feet. While the ground is freezing, the workers set up equipment on the surface and prepare for shaft sinking. When the ground is frozen, the shaft is excavated to approximately 100 feet and lined with reinforced concrete. This allows installation of the underground shaft sinking equipment.

Shaft sinking then continues below the 100-foot level in approximately 20- to 30-foot segments. A preliminary shaft wall lining of concrete blocks is installed with each section. This process is repeated down past the lowest major aquifer into the relatively impervious rock formation below it. A watertight lining made of an outer steel shell with an inner concrete lining will be placed inside the preliminary concrete block lining. This is installed from the bottom of the shaft to the surface. Watertight seal material is installed between the steel and block lining. Special seals will also be installed where needed below aquifer zones. This will prevent ground water from moving down the shaft and will protect water quality.

The final lining system is supported by a large reinforced concrete foundation. This steel, concrete, and seal liner system provides structural support and serves as a water barrier. At this point, the freeze plant will be turned off, and shaft sinking continues to a depth of 2,500 feet in 20- to 30-foot sections, including emplacement of the concrete lining. Minor inflows of water can be treated locally by adding segments of steel lining. If the engineering design borehole indicates a great amount of water will be encountered, the shaft can be lined all the way down with watertight steel casing.

When the shafts are completed, they will be connected at the bottom to establish ventilation and provide two means of safe evacuation. A testing program is being planned to monitor the performance of the shafts. After construction of the exploratory shafts, and throughout the geologic and engineering studies, the shafts will be monitored for stability and subsurface performance of lining and seals. If the site is not selected for further development, DOE will restore it as closely as possible to its original condition by filling the subsurface excavations and shafts with stored salt and other mined rock and by placing seals and plugs at required intervals to prevent water migration.

3 Would repository shafts also be built so that the Ogallala would not be threatened?

Shafts to the repository level will be designed and sealed to prevent water from leaking downwards. The shaft lining will be designed to ensure isolation of aquifers. Special seals will be installed to protect and isolate aquifers such as the Ogallala and Dockum (Santa Rosa). As the repository reaches its prescribed capacity of waste packages and is decommissioned, the repository drifts (tunnels) and shafts will be backfilled with the same material that was excavated from those areas during construction. The shafts will then be plugged and sealed.

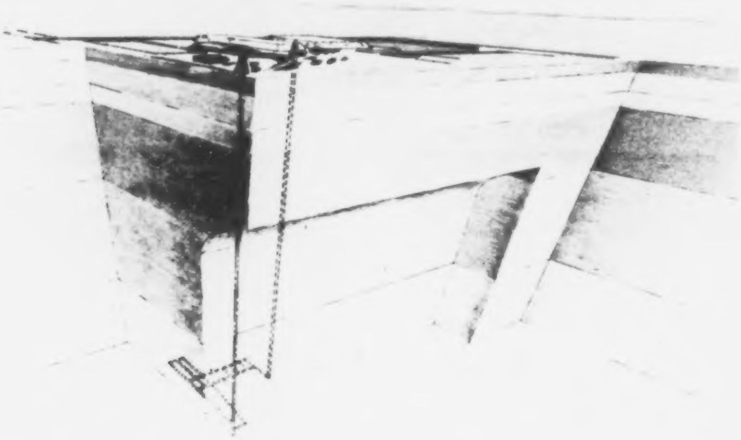
4 Could the Ogallala aquifer become contaminated or be threatened by the drilling and exploratory shaft construction?

Since no high-level nuclear waste would be involved in any drilling, exploratory shaft construction, or other site characterization activities,* there is no risk of radioactive contamination. There could be personnel risks related to shaft construction as there would be during any large construction project. Many precautions would be taken to preclude any threat or possibility of contaminating the Ogallala and Dockum aquifers during shaft construction.

The shafts would be specially lined with a casing and sealed to prevent pollution or depletion of the aquifers (see the response to question 2). Material excavated during shaft construction would be stockpiled on the site and precautions would be taken against seepage of runoff water or blowing salt dust (see the response to question 5). The shaft would be monitored to help ensure the integrity of the casings and seals.

5 How will DOE protect the Ogallala aquifer from the pile of excavated salt?

As much of the excavated material as possible would be used as backfill in the repository.



Exploratory Shaft Facility Concept

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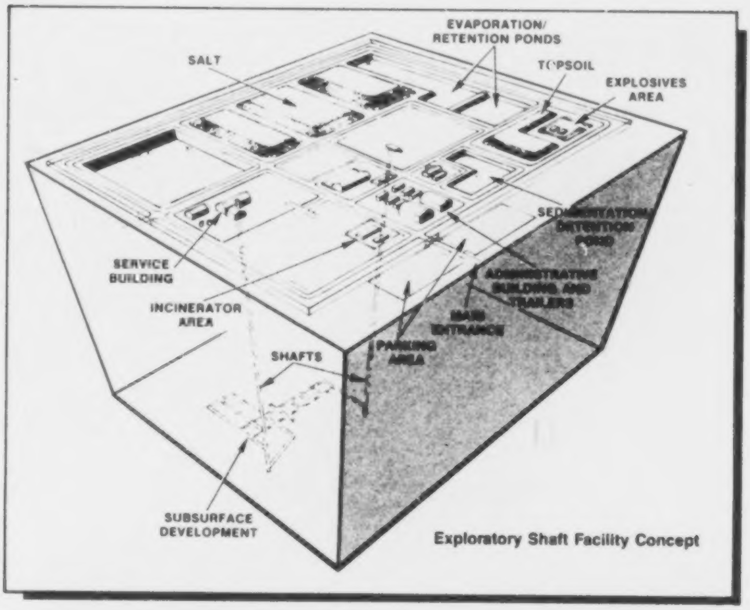
*The Nuclear Waste Policy Act of 1982 prohibits use of any radioactive material during site characterization, unless the Nuclear Regulatory Commission concurs that such use is needed to provide complete data required for environmental reports and a construction application.


EVAPORATION/
RETENTION PONDS
SALT
TOPSOIL
EXPLOSIVES
AREA
SEDIMENTATION/
DETENTION
POND
ADMINISTRATIVE
BUILDING AND
TRAILERS
MAIN
ENTRANCE
PARKING
AREA
SERVICE
BUILDING
INCINERATOR
AREA
SHAFTS
SUBSURFACE
DEVELOPMENT

Exploratory Shaft Facility Concept

However, there would be excess amounts of salt which will be disposed of. Initially, the excavated material would be stockpiled on the site before disposal or use as backfill. Rainfall runoff in the loading, transferring, and stockpiling areas would be carefully controlled to prevent migration of dissolved salt into surface or ground-water sources. The ground surface under and around the salt pile must be graded to provide adequate drainage and covered with a flexible, impermeable liner. The surface must be prepared to prevent liner punctures or tears. Additional precautions must be taken to prevent infiltration by rainwater and to control blowing salt dust.

Water that infiltrates the stockpile would be intercepted by the liner and drained to an evaporation/retention pond. This pond would also be used for any water that may be pumped from the shaft. Climatic conditions in Texas are suitable for evaporating retained water. The pond must be designed to be of large enough capacity to handle a 100-year flood.* In the event that adequate evaporation does not occur, retained water can be removed and transported to a state-licensed disposal site. The pond must also be lined with an impermeable liner to prevent seepage. Monitoring wells will be installed around the stockpile and other repository facilities to monitor water quality in the Ogallala.

Studies are currently in progress to determine the best salt disposal method for each

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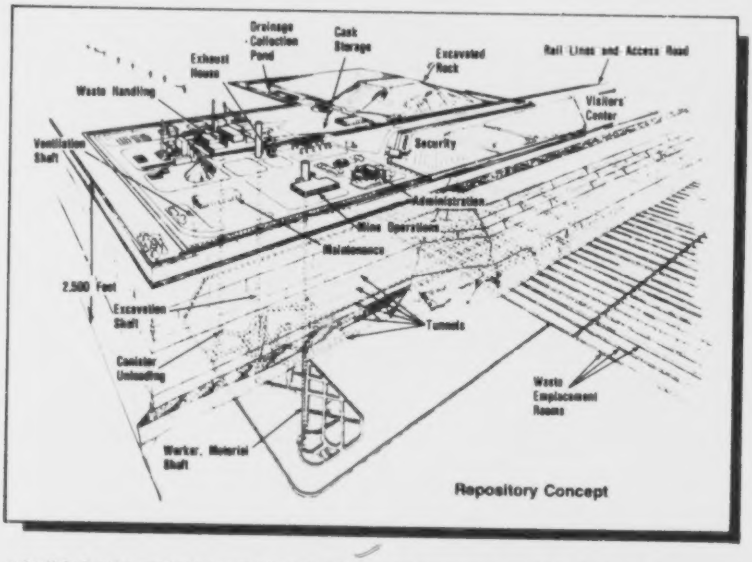
*A storm that may occur once every 100 years.


Drainage Collection Pond
Cask Storage
Exhaust House
Excavated Rock
Rail Lines and Access Road
Waste Handling
Visitors' Center
Ventilation Shaft
Security
Administration
Mine Operations
Maintenance
2,500 Feet
Excavation Shaft
Tunnels
Canister Unloading
Waste Emplacement Rooms
Worker, Material Shaft

Repository Concept

potential site; the methods eventually selected will depend, in part, on the site selected. The project's repository architect/engineer will address this and other issues more completely during site-specific conceptual design activities. The salt could be disposed of in abandoned or operating mines, on the commercial market, in the Gulf or ocean, in alkaline flats or dried saline lake beds, or in an onsite landfill. A combination of several methods could be used to dispose of all the salt.

6 Who is liable for cleanup costs or damages if the aquifer is contaminated or depleted despite these precautions?

If, despite the precautions, the aquifer were damaged as a result of a nonnuclear-waste-related incident, the federal government and/or the contractors would be liable and responsible for cleanup of any localized contamination, as well as for containment and monitoring. If there were radioactive contamination, the Price-Anderson Act, which assures compensation, would apply.

7 Could water flow from the Ogallala aquifer down to the salt where the repository would be and dissolve the rock?

Although there is a potential for downward flow in the rock formations in the area, there is no known natural connection between the Ogallala aquifer and the layer of salt where the repository would be located (see the response to question 1). The possibility of a connection will be thoroughly evaluated during site characterization and will be one of the issues evaluated by the NRC. Water could flow from an upper aquifer, such as the Ogallala, to the layer of salt at repository depth if a well were drilled to the repository depth and left open, or if shafts were improperly sealed. To prevent this, there would be a control zone surrounding the repository facilities. No drilling would be permitted in this control zone. Any existing holes would be plugged and sealed before repository operations begin. The repository shafts would be lined and sealed (see the response to question 2) so that water would not travel through them to the repository level.

During repository operation, any small amount of water that would be present in the repository would be evaporated as a result of the circulation of fresh air from the ventilation system. The repository temperature would be kept above the dew point at which water would start to accumulate. If larger amounts of water were present in the repository due to unexpected conditions, such as a pocket of brine, the water would be pumped out. The pumps used (called a "dewatering system") would be designed to handle relatively routine conditions and unexpectedly high water inflows. The water pumped out of the repository would be drained to an evaporation/retention pond. A similar dewatering system has been included in the preliminary designs for the exploratory shaft facility.

Dissolution is caused by a large amount of fresh water coming into contact with the salt. As fresh water dissolves salt, the water becomes increasingly saline until it is saturated (too saline to dissolve salt). Dissolution would continue only if the saturated water is removed and more fresh water is brought into contact with the salt. Because of the shaft sealing, control zone, ventilation system, and dewatering system, there would be no continuous flow of water from the Ogallala aquifer to the repository in quantities significant enough to dissolve the salt.

8 How much water would be used for exploratory shaft activities?

The average annual freshwater use for exploratory shaft activities will be about 47 acre-feet per year, enough to irrigate 53 acres. It would take more than that much water per year to irrigate 61 acres of land (the approximate size of the potential exploratory shaft site).

The peak work force during site characterization is expected to be about 480 workers. Some of these workers would be hired locally, while others would relocate to surrounding communities. Since many of the jobs during site characterization are of short duration, only some workers are expected to relocate with their families. Each additional resident requires approximately 150 gallons of water per day. Assuming that 10 percent of the peak work force would be hired locally, the relocating workers will use an additional 156 acre-feet per year at the peak work force size. These workers will be using municipal water sources since they will be living in communities near the site area.

9 How much water would the repository use?

This question will be addressed completely during site-specific conceptual design activities. However, DOE can provide the following preliminary estimates.

Water requirements for a repository in the Texas Panhandle during the 30-year waste emplacement period are now expected to average approximately 289 acre-feet per year, depending on the quality of water and the amount of wastewater reuse. This is equivalent to the amount of water needed to irrigate from 170 to 263 acres of cropland, an area that is significantly smaller than the size of a repository site.* Information is being collected to allow comparisons with water uses for specific crops.

The water requirements for the 7-year repository construction period are expected to be approximately 552 acre-feet. In addition, the peak-year municipal water needed for new workers and their families during the construction phase would be approximately 420 acre-feet per year. During repository operations, the average demand for new workers and families would be about 300 acre-feet per year.

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*Approximately 408 acres for surface facilities.

If a repository were in operation today, calculations indicate that it would use less than 1 percent of the water used in Deaf Smith County, based on 1980 water-use figures. By the year 2020, projections indicate a repository would still use less than 1 percent of the water used in Deaf Smith County.

During regional and area studies, DOE accumulated information about water use and trends. Data sources included the Texas Department of Water Resources, the U.S. Department of Agriculture, and the U.S. Department of Commerce. Water use will continue to be studied to help evaluate the effects of a repository on future Panhandle water needs.

10 How would water be used at the repository? Would it become contaminated?

Water requirements include:

- Cooling tower water for plant operations (nonradioactive uses)
- Potable water for site workers (drinking water, restrooms, cafeteria, etc.)
- General plant water (steam, maintenance, etc.)
- Radioactive uses.

Of the categories of water usage listed above, the largest amount of water would be used for the cooling towers (about 200 gallons per minute). Cooling tower water would not be contaminated with radioactive materials during normal repository operations. Under extreme accident conditions, any contaminated water would be contained, collected, and treated in an onsite facility (see discussion below). Cooling tower water would be monitored constantly. There would be back-up systems in case of monitoring equipment failure. Routine cooling water "blowdown"* would be conducted as it is in other large industrial facilities. "Blowdown" water would also be treated for any salt and chemicals present before it is released.

Water for radioactive uses is estimated to be 20 gallons per minute. This water results from decontamination of materials from analytical labs, hot cells, laundry, and any contaminated transportation casks. This contaminated water is considered low-level waste and would be collected and treated in the onsite facility. In this facility, the waste products would be separated from the water and solidified for packaging and disposal. Radioactivity would be contained during the process through engineered barriers. The type of low-level waste to be treated in the facility is comparable in radioactivity level to the low-level waste resulting from a hospital's nuclear medicine department. The processes used to treat the materials are also similar. There is no intention to indefinitely store any contaminated water on site; it would be processed as it is generated. The amount of water contaminated with radioactive material at a repository would be so small and well contained that the possibility of it reaching the Ogallala aquifer would be practically nonexistent.

11 How would water use for the repository affect the water levels of adjacent landowners?

Calculations of the effect of repository water use will be made for the specific site selected for detailed study. The effect of water use on adjacent landowners is discussed in the environmental assessment for the Deaf Smith site (DOE/RW-0069). During repository construction, the estimated maximum drawdown 1.5 miles from the onsite wells is about 0.3 feet. During repository operation, the maximum drawdown to wells located 1.5 and 3 miles away is estimated to be 2.2 and 0.7 feet, respectively.

Generally, if the repository were sited on land that is now irrigated, the repository would

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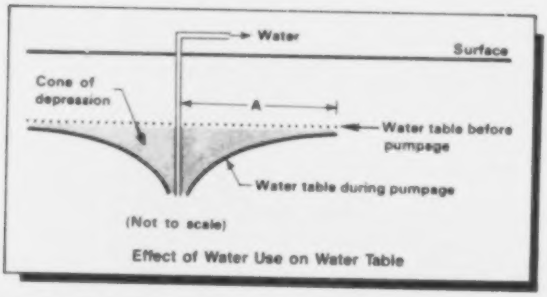
*"Blowdown" is a routine evacuation of the cooling water.


Water
Surface
Cone of depression
A
Water table before pumpage
Water table during pumpage
(Not to scale)

Effect of Water Use on Water Table

use less water than the amount needed to irrigate land the size of a repository site (see the response to question 9). In this case, there would be no effect on the adjacent landowners' supplies.

If the repository were located at a site at which there was no irrigation prior to construction, there could be some effect on adjacent landowners. This could occur because, when any well is drilled and used, a cone of depression forms in the water table (see the figure on this page). The distance (marked "A") is unknown until calculations are made concerning (1) the aquifer properties and (2) the size of the repository site control zone. Until these two factors are determined, it is not known whether adjacent landowners would be adversely affected by repository water use.

OCRWM ***Office of Civilian Radioactive Waste Management***

In 1982 Congress passed the Nuclear Waste Policy Act that established the nation's nuclear waste program. The Office of Civilian Radioactive Waste Management was created by the act to fulfill the Congressional mandate. The program is funded by the generators and consumers of nuclear electricity and by the nation's defense activities. For further information about the national program, write to:

Office of Civilian Radioactive Waste Management
U.S. Department of Energy
Mail Stop RW-40
Washington, D.C. 20585
(202) 586-5722

For additional information about specific site studies, write to:

Salt Project
Salt Repository Project Office
U.S. Department of Energy
110 North 25 Mile Avenue
Hereford, Texas 79045
(806) 374-2320

Tuff Project
Public Affairs Office
U.S. Department of Energy
Box 14100
Las Vegas, Nevada 89114
(702) 295-3521

Basalt Project
Public Affairs Director
U.S. Department of Energy
825 Jadwin Ave
P.O. Box 550
Richland, Washington 99352
(509) 376-7501

Technology Development Program
Office of Communications
U.S. Department of Energy
9800 South Cass Avenue
Argonne, Illinois 60439
(312) 972-2010

Information Offices:

Hereford
115 East First
Hereford, Texas 79045
(806) 364-0101

Tulia
102 S.E. Second
Tulia, Texas 79088
(806) 995-2519

Vega
I-49 and State Route 385
Vega, Texas 79092
(806) 267-2121

1987

POST-HEARING QUESTIONS

U.S. NUCLEAR REGULATORY COMMISSION

JUNE 29, 1987

QUESTION 1. I want to pursue a point you made on page 7 about exhausting surface-based testing prior to sinking of shafts. You say that this is desirable for two reasons, namely (1) shaft sinking could interfere with some surface-based tests, and (2) surface-based testing can resolve some issues at a relatively low cost, prior to committing major resources to the shaft drilling effort. If schedule were not an issue, and if you could choose a logical sequence of testing, how would you proceed in the site characterization work so as to maximize the value of the results and minimize upfront costs? How would this sequence affect the overall timing for site characterization, that is, how much more time would it take to perform tests sequentially rather than simultaneously?

ANSWER.

If overall schedule were not an issue, NRC staff believes that certain technical concerns at each site could be investigated through surface-based testing sufficiently to determine if disqualifying conditions are present. NRC staff has prepared the attached table which identifies current principal technical concerns for each of the three candidate sites and the predominant approach for resolving these issues based on the judgement of the NRC staff. If this judgment is correct, it might be a basis for DOE's development of site characterization plans which focus initially on surface-based testing which could potentially identify disqualifying conditions. Where such surface-based testing does identify a disqualifying condition, there would be no need to undertake at-depth testing which would require exploratory shafts at that site.

QUESTION 1. (Continued)

Since NRC is not responsible for developing site characterization plans, staff has not addressed the sequencing of tests and associated schedules and costs. This can best be done by DOE which does have responsibility for these aspects. NRC staff has provided the attached table to DOE for its consideration in developing its site characterization plans for the three candidate sites.

MAJOR ISSUES AND RESOLUTION APPROACH

ISSUE	PREDOMINANT APPROACH	
	Surface-based and/or Laboratory Testing	Underground Testing and/or Shaft Sinking
Hanford Site		
o Characterization of Groundwater Flow System	X	
o Tectonic Stability	X	
o Radionuclide Retardation	X	
o Container Lifetime	X	
o Repository Constructability/ High In-Situ Stress		X
Yucca Mountain Site		
o Presence of Potentially Active Faults in the Vicinity of Yucca Mountain	X	X
o Potential for Hydrothermal Activity in the Vicinity of Yucca Mountain	X	
o Groundwater Flow		X
o Effectiveness of the Potential Radionuclide Retardation Mechanisms Available at Yucca Mountain	X	
o Potential for Volcanism in the Vicinity of Yucca Mountain	X	
Deaf Smith Site		
o Potential for localized salt dissolution along faults acting as groundwater flow paths	X	
o Effects of heterogeneities in the salt units on repository constructability and retrievability	X	X
o Potential for shaft seal failures resulting in groundwater inflow		X
o Potential for localized corrosion of waste package in a brine environment		
--Brine migration/chemistry		X
--Localized corrosion	X	

77-688 718

QUESTION 2. From your initial exposure to DOE's quality assurance program, do you feel that DOE could use a little "coaching" from your people, who are most experienced in rigorous QA requirements relating to the licensing of commercial nuclear power plants?

ANSWER.

During the current pre-licensing consultation phase of the repository program, NRC staff has focused its contact with the U.S. Department of Energy (DOE) quality assurance (QA) program on lessons learned in QA from the power reactor program. This has included briefings by NRC quality assurance and legal staff for DOE management, staff, and contractors. The NRC staff has also prepared guidance documents on key QA areas of concern. In addition, the NRC staff observes DOE's QA audits of its own work and has begun independent NRC audits of selected critical portions of DOE's program. We believe that this proven comprehensive approach will best enable DOE to meet its responsibilities in this important area.

6/30/87 JOHNSTON Q2
NMSS

QUESTION 3. In your statement, you mention that NRC is working with DOE to identify areas where surface-based testing may be required prior to the sinking of exploratory shafts.

(a) Are there areas where it may be possible to obtain conclusive data for some of the potentially disqualifying factors by surface-based testing prior to drilling an exploratory shaft?

ANSWER.

The table provided in response to Question 1 identifies technical issues which the NRC staff considers could be resolved predominantly through surface-based and/or laboratory testing.

QUESTION 3. (Continued) -2-

(b) In your view, would it be desirable to focus on this testing first?

ANSWER.

NRC believes it would be desirable to focus on this testing first in cases where: (a) shaft construction would render necessary surface testing impossible or meaningless; and (b) such testing would reveal information about site suitability important to know before major resources are committed for shaft construction. It should be noted, however, that ultimately testing at repository depth would be necessary to ensure the adequacy of any site.

QUESTION 3. (Continued) -3-

(c) Is the Department's program structured to address these issues prior to sinking exploratory shafts?

ANSWER.

The Site Characterization Plans being developed by DOE will be the first indication of whether DOE's program is structured to address these issues. In one case, of which NRC is aware, DOE's program is structured on this basis. Specifically, as reported in the Mission Plan Amendment presently before Congress, the DOE program has been restructured to obtain data on the groundwater flow system at Hanford prior to sinking of an exploratory shaft.

QUESTION 3. (Continued) -4-

(d) In your view, what technical issues at each site might be able to be resolved through surface testing?

ANSWER.

The table provided in response to Question 1 identifies technical issues which the NRC staff considers could be resolved predominantly through surface-based and/or laboratory testing.

QUESTION 4. You mention in your testimony that NRC is working to develop additional regulatory guidance to assist DOE in focusing on the relevant issues for licensing.

(a) To some extent, aren't NRC's regulations in this area still evolving?

ANSWER.

NRC regulations on repository performance are largely complete. We will shortly complete a rulemaking to conform our rules in 10 CFR Part 60 to the Environmental Protection Agency regulations, 40 CFR Part 191, which established the overall performance standard for the repository. DOE should be able to develop and implement Site Characterization Plans given the EPA standard and NRC regulations now in place. Our regulations are sufficiently in place to permit DOE to proceed. Guidance, identifying approaches acceptable to the NRC staff for demonstrating that these first-of-a-kind requirements are met, is currently being prepared as necessary. The consultation between DOE and NRC during the current period of pre-application review is designed to identify and develop necessary guidance to DOE. DOE's issuance of Site Characterization Plans and NRC's review and analysis of these plans will provide the next opportunity for NRC to identify areas where additional regulatory guidance is needed and to develop plans for preparing guidance.

In order to make the licensing process more predictable, to the extent permitted by available information, understanding and resources, NRC will try to resolve technical issues in advance of formal licensing, through rulemaking.

6/30/87 JOHNSTON Q4
NMSS

In particular, we will try to arrive at satisfactory ways for DOE to demonstrate compliance with 10 CFR Part 60 performance requirements. While it is desirable to resolve as many of these issues as practicable before licensing, such efforts should not impair DOE's ability to proceed with development and implementation of Site Characterization Plans.

6/30/87 JOHNSTON Q4
NMSS

(b) Recognizing the difficulties NRC faces since it will ultimately have to license a repository, is it possible for NRC to better define its criteria so that DOE knows exactly what standards it needs to meet and what testing programs will accomplish that?

ANSWER.

As noted in the response to Question 4(A), NRC's regulatory criteria are sufficiently in place to permit DOE's program to proceed. As the program proceeds NRC staff will provide additional guidance on acceptable approaches for demonstrating that the criteria have been met. As the program evolves and as needs for additional guidance are identified, NRC will examine with DOE and other interested parties the appropriate areas and levels of detail for guidance. NRC will then be able to specify acceptable methods for DOE to demonstrate conformance to NRC standards. The NRC staff will explore with DOE and other interested parties how best to identify needs for guidance. The DOE Site Characterization Plans will provide an important opportunity for identifying these needs.

QUESTION 5. (a) Do NRC's criteria in any way limit the options available to DOE; such as reliance on multiple engineered barriers?

ANSWER.

NRC's criteria do not allow DOE to rely exclusively on either natural or engineered barriers to achieve the required level of overall performance. Both the NWPA and NRC's regulation require the use of multiple barriers. NRC's regulation establishes minimum levels of performance from the site, from the waste package, and from the engineered barrier system as a whole. If DOE can demonstrate that the overall system performance objective -- the Environmental Protection Agency's regulations in 40 CFR Part 191 -- is met, NRC's regulation allows some flexibility in adjusting the performance requirements of individual barriers in the overall system. For example, NRC's repository licensing regulations, 10 CFR Part 60.113(b) provides that, in case-by-case consideration of some other radionuclide release rate, designed nuclide containment period, or pre-emplacement groundwater travel time, the Commission may take into account the age and nature of the waste and the design of the underground facility.

6/30/87 JOHNSTON Q5
NMSS

QUESTION 5. (Continued) -2-

(b) Does NRC have standards available by which to evaluate long-lived canisters, or other engineering barriers?

ANSWER.

The NRC has standards available in 10 CFR Part 60, Disposal of High-Level Radioactive Waste in Geologic Repository, by which to evaluate performance of the waste package (which includes the canister) and the engineered barrier system. These standards include the performance objectives (10 CFR Part 60.113, Performance of particular barriers after permanent closure), the design criteria for the waste package (10 CFR Part 60.135, Criteria for the waste package and its components) and quality assurance for the repository and its subsystems and components (10 CFR Part 60, Subpart G, Quality Assurance).

NRC staff has also issued guidance for an acceptable method of analysis to demonstrate with reasonable assurance whether specific waste package designs will meet the performance requirements.

6/30/87 JOHNSTON Q5
NMSS

QUESTION 6. Suppose Congress were to pass legislation that did the following: placed a moratorium on site-specific work toward siting both a repository and MRS; set up a commission to study solutions to nuclear waste disposal; and directed NRC to promulgate regulations requiring each NRC licensee that generates or stores spent fuel to provide for safe storage onsite or at an offsite independent spent fuel storage installation for 30 years after expiration of that licensees' reactor operating license (draft legislation proposed by Senator Sasser, et. al. attached).

(a) Would NRC be able to estimate the cost of licensing onsite storage to this magnitude?

ANSWER.

Under the conditions stated, virtually every reactor site would require storage capacity to accommodate all spent fuel generated throughout the life of the reactor and would be required to continue such storage for 30 years after expiration of the reactor operating license. Since the storage capacity needed would most likely exceed reactor basin capacities, additional onsite storage capacity would be required. This would most likely be in the form of some type of dry storage, cask, module, or vault. Based on our licensing experience with two such cases we estimate that the cost to license this dry storage for an initial license period for up to 20 years would be about $200,000 per site. The cost to renew the license for a 20-year period would probably be about the same in constant dollars. The capital cost to construct such capacity is estimated to be $40 - $110 per kilogram (Department of Energy Monitored

Retrievable Storage Submission to Congress Volume II, Environmental Assessment for a Monitored Retrievable Storage Facility, February 1986). The total amount of spent fuel stored per site would depend on reactor power level and length of time of operation. However, typically a reactor would generate about 30 tonnes of fuel per year. This will result in an estimated range of capital cost of $48,000,000 - $132,000,000 for fuel generated in 40 years of operation.

Reactors may operate for only up to an initial 40 years or may seek license renewal from the Commission to operate for an extended period of up to 20 years. With the assumption of storage for 30 years after license expiration, NRC staff will continue to have to perform inspection activities at each reactor site. Whether or not a resident inspector is required for each site or there is one inspector for some number of sites, clearly a much larger inspection force will be required for dozens of reactor sites than the two resident inspectors expected to be stationed at an MRS facility. Moreover, the cost of operating reactor sites for 30 years of storage will not be inconsequential to utilities. For the 30 year period, the costs of providing personnel for site security, operations and maintenance, and the costs for power and other services for continued storage of fuel in the reactor basin and/or in onsite dry storage will be a continuing expense for each site.

6/30/87 JOHNSTON Q6
7/21/87/NMSS

QUESTION 6. (Continued) -3-

(b) What would be the regulatory impact or the impact on health and safety from such legislation?

ANSWER.

The Commission has already examined the regulatory impacts and impacts on health and safety of storage of spent fuel up to 30 years after expiration of licensees' reactor operating licenses in its "Waste Confidence" decision (49 FR 34658, August 31, 1984). In its fourth finding in that proceeding, the Commission stated: "The Commission finds reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of that reactor's operating licenses at that reactor's spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations."

The Commission has also issued regulations to assure that the matter of extended spent fuel storage is covered under 10 CFR Part 50 and Part 72 on or off reactor sites.

While NRC has regulations in place to address extended onsite storage, such storage would require additional regulatory staff inspection effort. For all those reactors with expired operating licenses which continued to store fuel onsite for 30 years, NRC inspection activities would continue. While one resident inspector might serve several sites, dozens of inspectors would still be required. For an MRS facility two resident inspectors are expected to be employed.

6/30/87 JOHNSTON Q6
7/21/87/NMSS

Utilities would continue to have to maintain their quality assurance programs, and these might have to readdress design and construction activities should a need arise for replacement of existing structures, systems, or components. Occupational doses on an annual basis at operating reactors would not change significantly and, assuming storage-only at shutdown reactor sites, occupational doses would be minimized. However, there would be a cumulative effect from continued storage.

Since fuel would remain onsite, reactor sites could not be fully decommissioned. Further, given security considerations, it also is unlikely that some sections of sites (which might otherwise be released to early unlicensed use, excluding contaminated structures, etc.) could be allowed to revert to public use until spent fuel could be removed from the site.

6/30/87 JOHNSTON Q6
7/21/87/NMSS

QUESTION 7. On page 10 of your testimony, you discuss the NRC staff's first audit of DOE's quality assurance program. Please elaborate on the scope and findings of this audit. Please provide as much specific detail as possible. What was reviewed, what areas of deficiency were found, what corrective action does the NRC staff recommend be taken, etc.

--What additional audits, if any, will be conducted by the NRC staff prior to site characterization?

ANSWER.

During the week of June 8, 1987, the NRC staff conducted its first audit of DOE's QA program for the high-level waste repository. The audit team assessed the quality assurance measures applied to the mineralogy/petrology studies at the Los Alamos National Laboratory (LANL). These laboratory investigations are collecting data which will be used to help resolve issues associated with geochemistry aspects at the Yucca Mountain, Nevada site.

LANL has a QA program designed to meet the Commission's quality assurance requirements. Systems, plans and procedures have been put into place, and staff and contractors hired and trained. The audit team, however, found several areas where improvements are needed to ensure the QA program is fully in place. These are summarized below:

- Procedures--LANL does not have in place all of the procedures necessary. In addition, some portions of existing procedures were not being followed by the LANL staff.

- Internal audit program--LANL is required to establish an internal audit program to assess the effectiveness of its own QA program. Although a program is in place, it had not detected deficiencies which were detected by an audit conducted by DOE's Nevada Project Office, nor those detected by NRC's audit. Thus, LANL's own audit program needs to be strengthened.

- Documentation of qualifications and training of personnel--although the audit revealed no substantive problem with regard to technical personnel training and qualifications, the records in this area were incomplete.

The specific deficiencies will be identified in an NRC report to be issued in the near future. The staff will be recommending that DOE correct the specific deficiencies found in the limited area audited by NRC, and also review their QA program for actions needed to ensure their own audit programs detect these types of deficiencies.

NRC currently plans to audit a selected portion of the hydrological testing program at the Hanford Washington site in the fall of this year. Other areas will be selected based on DOE's identification of areas they consider are ready based on their own QA auditing program, at the rate of about one per quarter.

APPENDIX II

Additional Material Submitted for the Record

STATE OF TEXAS
OFFICE OF THE GOVERNOR
AUSTIN, TEXAS 78711

WILLIAM P. CLEMENTS, JR
GOVERNOR

July 14, 1987

The Honorable J. Bennett Johnston
United States Senator
Chairman, Committee on Energy and Natural Resources
312 Hart Senate Office Building
Washington, D.C. 20510

Dear Senator Johnston:

I am writing to provide you with some additional information on the progress and implementation of the High-Level Nuclear Waste management and disposal program that is being carried out by the U. S. Department of Energy, pursuant to the Nuclear Waste Policy Act of 1982. I am aware of your continuing interest in guiding the nation toward a timely, safe and acceptable waste management and disposal program. We, in Texas, share that goal, and have participated in the federal program, in its various forms, since 1976. As you are aware, on May 28, 1986, the President accepted the recommendation of the Secretary of Energy that a site in Deaf Smith County, in the Texas Panhandle, be named as one of three Candidate Repository Sites in the nation. The other two sites selected for detailed site characterization, prior to the recommendation of one site for a permanent high-level waste repository, are at Yucca Mountain, Nevada, and the Hanford Reservation in Washington.

The attached information may be of interest to you in that it will further clarify our interests and concerns in three major areas of our experience with the DOE's program. The attachment is a copy of responses to three specific post-hearing questions from Senator Symms, a member of the Nuclear Regulation Subcommittee of the Senate Committee on Environment and Public Works. The questions followed a June 2, 1987, Subcommittee oversight hearing, chaired by Senator John Breaux, on the nuclear waste repository program.

The questions address three areas of interest: 1. Texas' efforts as an affected state to encourage and assist the participation of local citizens and affected local governments in the Candidate Site area; 2. Texas' concerns regarding the geotechnical screening program, and examples of why we believe that the Deaf Smith County site is not a suitable Candidate Repository site; 3. Texas' relations with the DOE in regard to implementation of the Consultation and Cooperation provisions of the Nuclear Waste Policy Act, and subsequent decisions of the Congress regarding program funding.

July 14, 1987
Page 2

I would like, especially, to call your attention to Question 2, regarding continuation of site characterization plans and activities. You will note that my response includes a description and discussion of a May 12, 1987 accident at the West German nuclear waste repository site under construction and study at Gorleben. The geology in that area, including groundwater conditions, is similar to the geologic setting at the Deaf Smith County site, with the exception that the Gorleben host salt is a salt dome, rather than a salt bed, as at the proposed Deaf Smith site. The shaft construction method, which resulted in the significant accident, is essentially the same as that proposed by DOE for use at the Deaf Smith site. Of further interest is the fact that the DOE did not volunteer informatin regarding the May 12 accident to affected parties, or the Congress, until pressed on the matter in early July. The attached news clip, from the *Amarillo Daily News*, refers to the situation. You will note that the attachments to my post-hearing responses indicate that the failure occurred in the frozen ground associated with shaft construction, contrary to the final paragraph of the *Amarillo Daily News* clip, in which a DOE representative speculates otherwise. In addition, DOE closely observes the Gorleben project, in part because of its similarities to the Deaf Smith site, yet quotes in the clip suggest that the DOE is lacking information on the incident, and therefore did not volunteer even the fact of its occurrance during appropriate testimony, and at other times during a period of nearly two months following the incident.

We appreciate your continuing interest and support in resolving the national nuclear waste management and disposal effort and feel that the enclosed information provides still further support for the recently introduced Senate and House bills calling for a suspension of site specific investigations, including land acquisition, until recommendations of a select commission on policy and program review are received and acted upon by the Congress.

I hope the attached information is of use to you, and if you have questions regarding any aspect of our views on this important national program, please do not hesitate to contact me.

Sincerely,

Steve Frishman, Director
Nuclear Waste Programs Office

SF:dp
enclosures

cc: The Honorable Lloyd Bentsen, United States Senator
The Honorable Phil Gramm, United States Senator
The Honorable Joe L. Barton, United States Representative
The Honorable Beau Boulter, United States Representative
The Honorable John Bryant, United States Representative
The Honorable Larry Combest, United States Representative
The Honorable Jack Fields, United States Representative
The Honorable Ralph M. Hall, United States Representative
The Honorable Mickey Leland, United States Representative
The Honorable Morris Udall, U. S. House of Representatives
Chairman, Committee on Interior and Insular Affairs

The Plains Today

AMARILLO DAILY NEWS

SECTION C

THURSDAY, JULY 9, 1987

Technology planned for n-dump blasted

West German shaft accident prompts local criticism

By PHIL MILANO
Globe-News Energy Writer

HEREFORD – The U.S. Department of Energy praised technology it plans to copy to put a nuclear waste repository in Deaf Smith County at the same time it was proven faulty at a site in West Germany, a nuclear dump opponent in the Texas Panhandle charged Wednesday.

In early June, NuclearFuel Magazine and several other technical publications reported that on May 12, high pressure dislodged a 234-meter deep, 1.5-metric ton steel ring supporting an excavation shaft wall at a high level nuclear waste dump site in Gorleben, West Germany.

The ring fell on several workers at the bottom of the shaft, killing one and injuring five, two critically, according to official reports.

Some West German government officials have not ruled out the possibility of halting the shaft construction process entirely because of the accident, Nuclear Waste Task Force President Delbert Devin said at a news conference here Wednesday.

The accident has not been reported widely in U.S. media, Devin said, and DOE officials in Hereford neglected to bring it up in subsequent public meetings until questioning Wednesday morning.

"This is a pattern the Department of Energy has followed all the way through," he said. "They tell the truth that makes their project look good but don't tell the facts that make the project look bad."

He said DOE was attempting to shield the public from the information in order to not hamper site characterization work in Deaf Smith County and that residents should support legislation introduced recently in Congress to halt the nuclear waste program for two years.

DOE plans to freeze the area around two 12-foot diameter, 2,500-foot deep shafts during site characterization at the Deaf Smith site to avoid water exchange between three aquifers and to prevent a cave-in, department officials say.

According to documents obtained by the Globe-News, Jeff Neff, Salt Repository Project technical director, testified June 29 before the Senate Energy and National Resources Committee that the proposed freeze technology was a proven one used for 100 years.

"The technology for operating a repository is based on well-known principles and has been demonstrated successfully ... in the Federal Republic of Germany," Neff told senators.

He made no mention of the accident.

Devin said in a statement that the accident "gives added proof that the freeze technology is indeed proven – proven to be totally unreliable and unacceptable."

Neff could not be reached for comment Wednesday, but Roger Gale, DOE spokesman in Washington, said the department knew of the West German accident "within a day" after it happened and was prepared to answer any questions senators might have posed at the hearings.

No senator asked about the accident, Gale said, and DOE officials didn't offer the information without prompting because they were awaiting more details pending a West German investigation.

"We just don't know whether the accident has any bearing on the site in the Panhandle. Yes, the technologies are generally similar, but we're still studying exactly how similar they are," he said.

Gale said Neff's comments at the Senate hearing about the success of a site in West Germany were mainly in reference to a salt mine shaft in that country that has proven successful and not necessarily about the Gorleben site.

However, Neff also was probably "referring to the freeze technology at the Gorleben site and not the overall shaft technology, Gale said.

Hereford DOE spokeswoman Linda McClain added, "I'm fairly certain the accident (at Gorleben) occurred below the freeze wall, which means it was a mining accident, and there was not a problem with the freeze technology."

STATE OF TEXAS
OFFICE OF THE GOVERNOR
AUSTIN, TEXAS 78711

WILLIAM P. CLEMENTS, JR.
GOVERNOR

July 9, 1987

Senator John Breaux
Chairman, Committee on Environment
and Public Works
Subcommittee on Nuclear Regulation
Washington, D. C. 20510

Dear Senator Breaux:

I have your letter of June 16, 1987 in which you request my written response to post hearing questions submitted by Senator Symms regarding the Subcommittee's oversight hearing on the U. S. Department of Energy's program for the disposal of high-level radioactive waste.

My responses to the questions from Senator Symms are enclosed. If you or other Subcommittee members have further questions on this matter, please do not hesitate to contact me.

Sincerely,

Steve Frish

Steve Frishman, Director
Nuclear Waste Programs Office

SF:dp
enclosure

U. S. Senate Committee on Environment and Public Works
Subcommittee on Nuclear Regulation
Nuclear Waste Programs Oversight Hearing, June 2, 1987
Post Hearing Questions Submitteed by Senator Symms

QUESTION:

1. To what extent do you now involve your local communities in activities and decisions related to the DOE siting activities?

RESPONSE:

The Texas Nuclear Waste Programs Office (NWPO) is the office that coordinates the State of Texas oversight of the DOE high-level radioactive waste disposal program, pursuant to the Nuclear Waste Programs Act of 1982. As a function of this coordination, the NWPO is actively involved with affected and interested local governments and citizens in order to assist their effective participation in the DOE program. To this end, the following are examples of activities undertaken by the NWPO:

(a) The Nuclear Waste Policy Act of 1982 does not provide for specific direct funding to local government jurisdictions affected by the DOE program in order to promote their participation in the DOE's siting activities. The Act does provide for grants for payments-equal-to-taxes to a unit of general local government within which is located a candidate repository site. In the case of the Texas site, only the County of Deaf Smith is eligible for these funds, however, at this time, DOE has acquired no land for site characterization, therefore no payments are yet due for land holdings. If DOE purchases a site characterization facility site, as it plans, only about 61 acres of prime farmland may be involved, therefore the equivalent-to-tax payment for the land will be minimal, and not available to all affected jurisdictions such as school and hospital districts and nearby cities and towns. But, it is clear that the affected community, as a whole must have the ability to participate in the DOE program, and that the Congress did not intend that affected communities bear the expense of DOE program siting activities. Therefore, the Texas Nuclear Waste Programs Office (NWPO) has recommended that affected local governments join together in their efforts to oversee the DOE program and participate in its activities. Six affected jurisdictions in Deaf Smith County have contracted with each other to form the Waste Deposit Impact Committee (WDIC), and this organization of local governments is provided with funding and informational assistance by the NWPO. The member governments are: Deaf Smith County, the Herefore Independent School District, the Deaf Smith County Hospital District, the Walcott Independent School District, the City of Hereford, and the High Plains Underground Water District No. 1.

With the encouragement of the NWPO, other affected units of local government have joined together on a contractual basis and either have, or will shortly receive financial assistance from this office to assist in their review and oversight of relevant plans and activities of the DOE program. Three counties to the south and southeast of Deaf Smith County have joined together for this same purpose, primarily because marketing and brokerage of their major agricultural production is largely through Hereford, and any marketing impacts induced by the program will directly affect land valuations and governmental revenues for the three counties. The affected counties are Castro, Parmer, and Swisher. Three affected school districts are now in the process of joining together, by contract, to participate in DOE program review and oversight, and one, the Vega Independent School District is currently, with financial assistance from the NWPO, carrying out an educational services study in order to project the potential impacts of the DOE program on its programs, budgets and tax base. The Deaf Smith County candidate repository site is within the boundaries of the Vega and Hereford Independent School Districts, and the Vega school facility is located in the City of Vega, just eight miles from the site. Similar studies are planned for the two adjacent school districts, Adrian and Wildorado, once the contractual relationship is established among the districts. When established, this consortium of affected school districts will also receive financial assistance for its participation from the NWPO. The City of Vega, which is the County Seat of Oldham County, just north of the candidate repository site, has a population of about 900 people, and most of its public services are now oeprating at design capacity. Being nearest the site, it is expected that on-site work by DOE will result in significant impacts to that City. The NWPO is currently funding a public facilities and services study in the city, and plans will be developed to meet expansion and improvement needs projected, however, the City of Vega is also among those governmental jurisdictions that the DOE has determined are not eligible for impact assistance during site characterization, nor is it eligible for payments-equivalent-to-taxes under the NWPA. The entire matter of impact assistance to affected communities and the payment-equivalent-to-taxes for affected jurisdictions should be reviewed by the Congress if the obvious and urgent needs of the local jurisdictions are to be met in conjunction with the implementation of the NWPA.

(b) The NWPO has an ongoing program of providing funds from the Nuclear Waste Fund grant to the State of Texas to assist local public interest groups in their participation in the DOE program. Funds are provided, through contracts, for the purpose of assisting the groups in acquiring technical assistance in their reviews of DOE program and decision documents, such as Site Characterization Plans, Environmental Assessments, Mission Plan, Project Decision Schedule, land acquisition plans, socioeconomics and environmental plans, etc. In addition, funds may be used to assist representatives of the organizations in presenting their reviews to the DOE, and in meeting the expenses of travel to DOE meetings and hearings in which they participate and present their reviews and positions. The funds also assist the groups in their exchange of information with the NWPO, other public interest organizations, and affected local governments. The largest of the organizations assisted by the NWPO is the Nuclear Waste Task Force, a coalition of major Texas farm commodity groups that is headquartered in Hereford, Texas, the County Seat of Deaf Smith County. The Nuclear Waste Task Force has a strong interest in participating in the DOE progam in that Deaf Smith County ranks highest in Texas in value of agricultural production, with cash receipts known to exceed $500 million per year, accruing from such commodities as cattle and calves, wheat, sugar beets, corn, grain seed, vegetables, etc. The group's interest in the DOE program is further enhanced by the fact that the designated candidate repository site, and surrounding lands are almost entirely privately owned prime agricultural lands, which support, among other farms, a unique foundation seed farm that does not have an equal in the nation for its ability to bring newly developed grain seeds into commercial production. The Nuclear Waste Task Force is also interested in groundwater protection issues associated with the repository program, since the sole source of water for the needed irrigation of crops, and for potable water supply in the area is the High Plains Aquifer, which consists of the prolific Ogallala and Santa Rosa aquifers at the site. Both of these aquifers lie between the ground surface and the candidate host repository horizon in the deeply buried salt layers of the Palo Duro Basin.

Other public interest groups that have received similar funding and informational support from the NWPO are STAND (Serious Texans Against Nuclear Dumping) and POWER (People Opposed to Wasted Energy Repositories). These groups have a broad base of interest in the affected area, that includes agricultural as well as area-wide socioeconomic and environmental issues and impacts to affected local government jurisdictions.

In addition to the groups' using the information which is developed through the assistance fom the NWPO for reviews of past and current DOE program documents and plans, and their participation in program activities, the funding assistance is being provided to assure that the groups will have the ability, as necessary, to function as knowledgable participants in future DOE activities such as site characterization planning and scoping meeting for DOE's development of a site-specific Environmental Impact Statement.

The NWPO maintains close contact and coordination with the affected local governments and public interest groups in order to assist these organizations in necessary and relevant activities related to the DOE program, and to assure a continuing high quality of oversight without unnecessary duplication of work and commitment of resources. All participating parties have responded to the efforts and assistance of the Texas NWPO with enthusiasm and in a real spirit of interest and cooperation.

QUESTION:

2. If you have serious concerns about the technical suitability of your site, wouldn't you be willing to proceed to full site characterization along with oversight from the National Academy of Sciences and the Nuclear Regulatory Commission to better substantiate or alleviate your concerns? Why are you not willing to take the next step to prove scientifically the basis for your arguments that your site is unsuitable?

RESPONSE:

It is our position that, based upon available information and experience, the DOE has been overly optimistic in its geotechnical evaluations and conclusions regarding the suitability of the site for site characterization and repository construction, operation and closure. The known uncertainty of the proposed exploratory shaft construction technology remains understated by the DOE, when, if properly applied this factor should have resulted in the disqualification of the site pursuant to DOE's site recommendation guidelines (10 CFR 960). In addition, known uncertainties regarding the site characteristics, if properly applied, lead to the conclusion that it is highly unlikely that the waste retrievability requirements of 10 CFR 60, for repository licensing by the NRC, and the retrievability requirement of the NWPA can be met. These represent just two examples that serve to support our conclusion that the characterization of the Deaf Smith County site is not only an unjustified expenditure of time and resouces, but also presents unnecessary and potentially damaging risks to the people and environment of the Texas Panhandle area and its productive water supplies and agricultural economy.

Shaft Construction: We have previously informed the Congress and the DOE of our concerns regarding the uncertainties and significant failure record involved in the construction of mine shafts through aquifers by employment of the ground freezing technique. The DOE has consistently responded that this is a tried, tested and reliable technology, perfectly appropriate to its needs at the Deaf Smith site.

In the DOE's Environmental Assessment, Deaf Smith County Site, Texas, May, 1986, Table 6-12 cites the following two disqualification factors from the site recommendation guidelines (10 CFR 960), the DOE's assessment of the site relative to these factors, and the DOE's findings for use in nomination and recommendation of candidate repository sites:

960-5-2-9(d) Disqualifying Condition: The site shall be disqualified if the rock characteristics are such that the activities associated with repository construction, operation, or closure are predicted to cause significant risk to the health and safety of personnel, taking into account mitigating measures that use reasonably available technology.

Assessment Results: Potential hazards to personnel related to rock characteristics can be mitigated by standard mine safety and engineering practices.

Findings: The evidence does not support a finding that the site is disqualified.

960.5-2-10(d) Disqualifying Condition: A site shall be disqualified if, based on expected ground-water conditions, it is likely that engineering measures that are beyond reasonably available technology will be required for exploratory-shaft construction or for repository construction, operation or closures.

Assessment Results: Required engineering measures to be utilized in the construction of the repository are currently available.

Findings: The evidence does not support a finding that the site is disqualified.

The latest failure during construction by ground freezing of which we are aware occurred on May 12, 1987, at the Gorleben nuclear waste disposal site in West Germany where the geologic section above the planned host salt dome has a great deal of similarity to that in the upper part of the section at the Deaf Smith site, above the salt beds. The incident is described in the two attached (Attachment A and B) press accounts that relate details of the failure. There is much of significance to be found related to this incident and the DOE's analyses, activities and decisions associated with the Deaf Smith County site. As stated above, the shaft construction method involve ground freezing, as does the DOE's plan for the Deaf Smith site; the upper geologic sections at both sites have much similarity in thickness, rock types, depth planned for ground freezing, hydrologic conditions, and variability of sediment and rock types in the upper section; both are construction projects associated with nuclear waste disposal facilities for which the expectation is that the highest possible quality and conservatism of design and construction is to be applied; given the geologic and hydrologic setting at both sites, considerable uncertainly is to be expected regarding subsurface conditions as interpreted from borehole tests used in developing shaft plans and designs; and there is a major design priority, since both shafts are to bottom in salt, that there be no unplanned flow of water into the shaft during its construction and operation. It should also be noted that the failure of the Gorleben shaft occurred one month after installation of an engineered support designed in response to miners encountering an unanticipated underground pressure condition. Following the shaft-failure related worker death and injuries, the bottom 14 meters of the shaft were plugged with cement in order to avoid further structural collapse. The future of the Gorleben shaft is reported to be uncertain, and it may be necessary to abandon it, since repairs may not be feasible or safe.

Particular note should be taken of the fact that the Gorleben failure occurred *after* an unanticipated subsurface condition was discovered and the installation of a mitigating engineered response. It, reportedly, was *not* a failure on the shaft working face in the frozen ground. This heightens our concerns about the ability to construct a safe exploratory shaft facility and adds a great deal of additional uncertainty to the matter of whether a repository facility can be safely constructed and then support a finding of reasonable assurance that it will perform as predicted in the short and long term isolation of nuclear waste.

Aside from the tragedy and setback associated with the Gorleben shaft failure, and others in the past associated with the ground freezing technology, we question why the DOE, as late as approximately two months after the Gorleben incident had not informed interested and affected parties, such as the State of Texas and the Congress of this matter. The DOE closely observes the Gorleben nuclear waste project, in part because of the numerous similarities to the Deaf Smith County salt repository project. In addition, during June 1987, representatives of the Gorleben project visited the DOE Salt Repository Project Office, in Hereford, Texas, yet there was no known public mention of the incident by DOE or the West German representatives at that time. The DOE has had numerous opportunities to inform us, the Congress, and the interested and affected public of this significant incident, yet we first learned of the matter from an interested citizen in late June. On June 29, 1987, Mr. J. O. Neff, project manager of the Salt Repository Project Office, testified before the United States Senate Committee on Energy and Natural Resources regarding technical issues associated with the Deaf Smith County site and, while the opportunity clearly existed, failed to inform the Committee of this important incident. He did present written testimony that included a statement regarding the integrity of site characterization shafts, as follows:

> The concern is that the Ogallala and Dockum aquifers could be contaminated during construction of shafts for site characterization. This will be avoided through use of a proven (over 100 years old) ground freezing technique which is widely employed for digging tunnels and mine shafts where water is anticipated. For example, shafts for mines in Saskatchewan, Canada, have successfully penetrated major aquifers with ground freezing during shaft construction. This method is being tested during construction of the repository in the Federal Republic of Germany at Gorleben.
>
> As a part of shaft construction, seals and plugs will be placed at required intervals to prevent water from moving down the shaft as well as to protect water quality. Throughout the construction and operation process of the exploratory shaft facility and the repository, DOE will continuously monitor the shafts for stability and performance of the lining and seals.

Office of Civilian Radioactive Waste Management Director Ben Rusche has also failed in numerous recent opportunities, to inform the Congress of this matter in formal testimony, just as on June 11, 1987, in reporting on the DOE program progress to the assembled members of the Nuclear Regulatory Commission he did not volunteer this important information. We can only interpret this persistent silence on the part of DOE in two, equally disturbing ways: either the DOE program managers have failed to recognize the significance of this event to the technical integrity of our national repository program, or the intent was to avoid airing this potentially adverse information until a sufficiently specific question arose regarding the matter and a response was required.

Waste Retrievability: In regard to the matter of waste retrievability, salt creep rates in the Deaf Smith County site host salt are expected to have a significant impact on the ability to meet the NRC's repository licensing requirements, as stated in 10 CFR 60. The rule states:

> 60.111(b) - Retrievability of Waste. (1) The geologic repository operations area shall be designed to preserve the option of waste retrieval throughout the period during which wastes are being emplaced and, thereafter, until the completion of a performance confirmation program and Commission review of the information obtained from such a program. To satisfy this objective, the geologic repository operations area shall be designed so that any or all of the emplaced waste could be retrieved on a reasonable schedule starting at any time up to 50 years

> after waste emplacement operations are initiated, unless a different time period is approved or specified by the Commission. This different time period may be established on a case-by-case basis consistent with the emplacement schedule and the planned performance confirmation program. (2) This requirement shall not preclude decisions by the Commission to allow backfilling part or all of, or permanent closure of, the geologic repository operations area prior to the end of the period of design for retrievability.

This provision for retrievability is clearly linked to the planning and execution of a satisfactory performance confirmation program related to waste isolation in the repository, and the Commission's review of the performance confirmation data. The DOE's Deaf Smith County Environmental Assessment recognizes that underground room closure due to salt creep may cause difficulties in retrievability of the waste, and appears to rely upon permission to be granted for very early backfill of the waste emplacement rooms without a clear recognition of the NRC's clear intent in 10 CFR 60 for requiring waste retrievability. The EA states the following: (Page 5-46)

> The capability to retrieve the waste packages would be demonstrated prior to a decision to backfill the waste package storage rooms and would be maintained regardless of whether the storage rooms have been backfilled. Therefore, the decision to backfill would be based on an evaluation of the advantages of early backfilling versus the increased difficulty of retrieval.

However, the EA, on pages 5-12 and 5-13, in discussing room closure rate calculations and the factors to be considered, provides information that, first, makes it doubtful the waste emplacement rooms designed for a Deaf Smith County site could be kept in an open, safe, and accessable condition for more than about three years, and second, indicates that after emplacement, the maximum expected room temperature would be in the range of 167 to 212 degrees F. Our calculations, which seem to agree to some extent with the DOE's text, suggest that the closure rate prediction could be too low by as much as a factor of three, indicating that rapid backfill would become necessary almost immediately after waste emplacement. If this is the case, or even if the three-year prediction better reflects the actual condition, it is unlikely that the above DOE commitment from pages 5-46 can be met in a manner that would be found satisfactory to the NRC, based upon its need forperformance confirmation prior to permitting early backfill of the emplacement rooms. In addition, at the expected temperatures in the waste emplacement rooms shortly after emplacement of the waste, it may be found to be not only difficult, but impossible to retrieve the waste from a backfilled room, and still maintain worker safety through the use of reasonably available technology.

QUESTION:

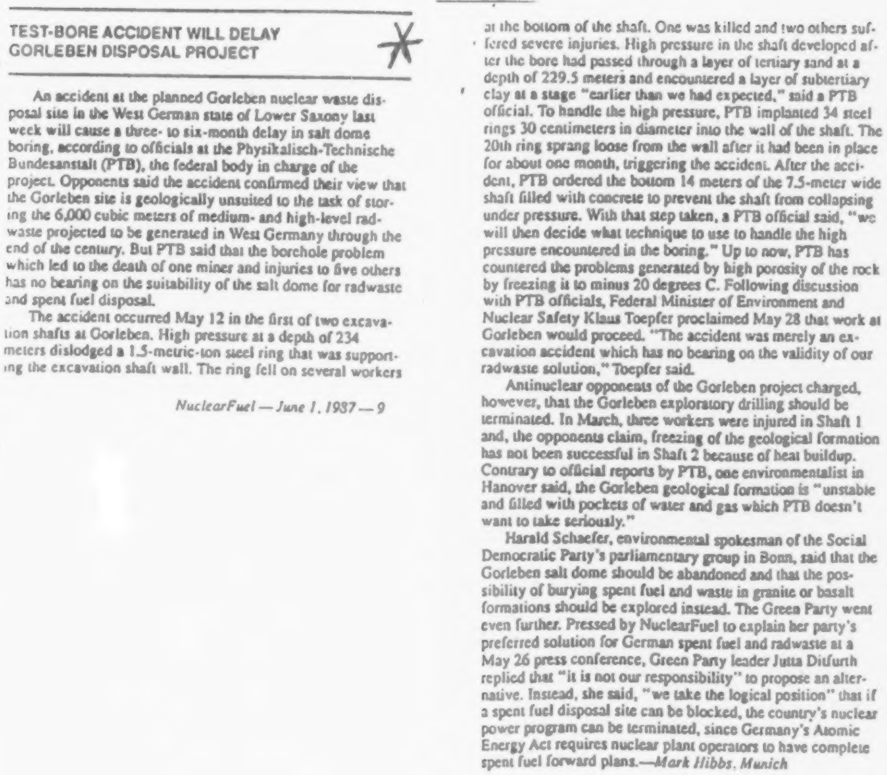
3. Have DOE's interactions with the States and Tribes improved since the passage of the FY 87 Continuing Resolution which was so highly critical of DOE's action in that regard?

RESPONSE:

The FY 87 Continuing Resolution spoke directly to the Secretary of Energy making a good faith effort in regard to seeking to negotiate a written Consultation and Cooperation Agreement with each affected State and Indian Tribe. The State of Texas, pursuant to Section 117(c) of the Nuclear Waste Policy Act, responded to the Consultation and Cooperation Report drafted by the DOE for submittal to Congress, and that response, which has since been submitted by the DOE is attached (Attachment C). Since our response, in January 1987, the DOE has made no further formal contact to the State in regard to initiating such a written agreement.

Consulation relations with the DOE Office of Civilian Radioactive Waste Management have not undergone any general improvements since passage of the FY 87 Continuing Resolution. Many of the primary issues of disagreement between affected States and Indian Tribes and the Department of Energy remain unresolved, including the fundamental apparent difference in our interpretation of the NWPA in regard to the meaning of the word "consultation". The Department of Energy continues to demonstrate that its understanding of the Act's requirement for consultation involves informing affected parties of plans and decisions of the Department, and matters that affect those plans and decisions, in a manner and at a time that the DOE determines such information should be made available. In the alternative, it is our understanding that consultation includes the necessity that all programmatic information be made available to the parties at a time early enough that it may be evaluated and permit our substantive and meaningful participation in the program decision process. We continue tc find ourselves in a situation in which we are lacking important information relevant to our participation in the DOE program because we were not aware of the precise question or information request to make of the DOE.

ATTACHMENT A



TEST-BORE ACCIDENT WILL DELAY GORLEBEN DISPOSAL PROJECT

An accident at the planned Gorleben nuclear waste disposal site in the West German state of Lower Saxony last week will cause a three- to six-month delay in salt dome boring, according to officials at the Physikalisch-Technische Bundesanstalt (PTB), the federal body in charge of the project. Opponents said the accident confirmed their view that the Gorleben site is geologically unsuited to the task of storing the 6,000 cubic meters of medium- and high-level radwaste projected to be generated in West Germany through the end of the century. But PTB said that the borehole problem which led to the death of one miner and injuries to five others has no bearing on the suitability of the salt dome for radwaste and spent fuel disposal.

The accident occurred May 12 in the first of two excavation shafts at Gorleben. High pressure at a depth of 234 meters dislodged a 1.5-metric-ton steel ring that was supporting the excavation shaft wall. The ring fell on several workers at the bottom of the shaft. One was killed and two others suffered severe injuries. High pressure in the shaft developed after the bore had passed through a layer of tertiary sand at a depth of 229.5 meters and encountered a layer of subtertiary clay at a stage "earlier than we had expected," said a PTB official. To handle the high pressure, PTB implanted 34 steel rings 30 centimeters in diameter into the wall of the shaft. The 20th ring sprang loose from the wall after it had been in place for about one month, triggering the accident. After the accident, PTB ordered the bottom 14 meters of the 7.5-meter wide shaft filled with concrete to prevent the shaft from collapsing under pressure. With that step taken, a PTB official said, "we will then decide what technique to use to handle the high pressure encountered in the boring." Up to now, PTB has countered the problems generated by high porosity of the rock by freezing it to minus 20 degrees C. Following discussion with PTB officials, Federal Minister of Environment and Nuclear Safety Klaus Toepfer proclaimed May 28 that work at Gorleben would proceed. "The accident was merely an excavation accident which has no bearing on the validity of our radwaste solution," Toepfer said.

Antinuclear opponents of the Gorleben project charged, however, that the Gorleben exploratory drilling should be terminated. In March, three workers were injured in Shaft 1 and, the opponents claim, freezing of the geological formation has not been successful in Shaft 2 because of heat buildup. Contrary to official reports by PTB, one environmentalist in Hanover said, the Gorleben geological formation is "unstable and filled with pockets of water and gas which PTB doesn't want to take seriously."

Harald Schaefer, environmental spokesman of the Social Democratic Party's parliamentary group in Bonn, said that the Gorleben salt dome should be abandoned and that the possibility of burying spent fuel and waste in granite or basalt formations should be explored instead. The Green Party went even further. Pressed by NuclearFuel to explain her party's preferred solution for German spent fuel and radwaste at a May 26 press conference, Green Party leader Jutta Ditfurth replied that "it is not our responsibility" to propose an alternative. Instead, she said, "we take the logical position" that if a spent fuel disposal site can be blocked, the country's nuclear power program can be terminated, since Germany's Atomic Energy Act requires nuclear plant operators to have complete spent fuel forward plans.—*Mark Hibbs, Munich*

NuclearFuel — June 1, 1937 — 9

ATTACHMENT B

wise
World Information Service on Energy/Service Mondial d'Information sur l'Energie/
Weltweiter Energie Informationsdienst/Servizio Mondiale d'Informazione Energetica/
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12 June 1987

waste

GORLEBEN WORKER KILLED IN SHAFT COLLAPSE (275.2338) WISE-Amsterdam

On May 12, there was a serious accident in the high level waste repository under construction in Gorleben, West Germany. Six workers were injured by a falling support as the shaft collapsed. One of the workers later died.

The cause of this accident was not faulty building material as the construction company first announced but a direct consequence of the geological conditions of which experts had already warned the PTB years ago. The PTB (Federal Institute for Science and Technology) is a department of the federal research ministry, which in fact owns the construction site of the permanent nuclear dump in Gorleben.

The shaft builders used several emergency methods to counteract the unexpectedly high underground pressures, including freezing the ground prior to sinking the shaft. To do this, 43 boreholes arranged in a circle 25 meters in diameter where sunk to a depth of 270 meters and filled with a calcium chloride brine at -40 degrees C. The freezing took one year, and the ground was to be kept frozen for two years while the shaft was sunk. Nevertheless, at a depth of 225 to 227 meters below the earth's surface, the shaft became severely deformed. Since the accident, this part of the shaft has been filled with concrete.

Neither the PTB nor the construction company know how to continue the construction of this permanent dumping facility for high level radioactive waste. "In this situation I can honestly not exclude the possibility, that the entire construction of the permanent dump will be stopped," said a spokesman of the PTB.

According to federal German nuclear law, a solution for radioactive waste has to be guaranteed before operating licences can be granted for nuclear power plants. Although there are not yet any facilities for reprocessing or dumping, state and federal governments agreed on a plan for radioactive waste management which was considered sufficient for granting licenses. Each step in the construction of the permanent dump facility in Gorleben (as well as that of the reprocessing plant in Wackersdorf) are considered as legal proof of this guarantee. If Gorleben is proved unsuitable for geological reasons, the fiction of a guaranteed solution for radioactive waste will be exposed and the legal basis for operating nuclear plants in Germany will no longer exist.

Source: TAZ, May 20/21; DIE ZEIT, June 6, 1987)

Contact: Martin Mombaur, Buergerinitiative Umweltschutz Luechow-Dannenberg, Drawehner Str. 3, 3130 Luechow, FRG. Tel: 05841-4684

ATTACHMENT C

OFFICE OF THE GOVERNOR
STATE CAPITOL
AUSTIN, TEXAS 78711

MARK WHITE
GOVERNOR

January 16, 1987

Mr. Ben C. Rusche, Director
Office of Civilian Radioactive Waste Management
United States Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Mr. Rusche:

I have your letter of December 23, 1986, in which you transmit to Governor Mark White, in accordance with Section 117(c) of the Nuclear Waste Policy Act, your report to Congress concerning negotiations with the State of Texas regarding a Consultation and Cooperation Agreement. Governor White has asked that I review your report and respond with comments, as provided in the NWPA.

Enclosed you will find our review of your December, 1986, report to be forwarded to Congress.

Sincerely,

Steve Frish

Steve Frishman, Director
Nuclear Waste Programs Office

SF:dp
enclosure

State of Texas Comments

Regarding
U. S. Department of Energy
December, 1986

Report to Congress Concerning Negotiations

with the State of Texas
as Required by

Section 117(c)
Nuclear Waste Policy Act of 1982

Mark White, Governor
January 1987

COMMENT 1

The U. S. DOE report does not state the "reasons why such agreement has not been completed", as required by Section 117(c) of the Nuclear Waste Policy Act of 1982.

The DOE, during the six month period May 28, 1986 - November 27, 1986, did not pursue the substantive written agreement process in a manner that could reasonably result in completion of an agreement within the stated period. Texas did not submit a written request to the Secretary to begin negotiations seeking an agreement prior to, nor during the 60 days following the (May 28, 1986) date on which the President approved the Deaf Smith County, Texas, site for site characterization. This option is available to Texas, according to the Act, therefore, it was the Secretary's duty to initiate the process during the period of time set out in the Act. The manner in which the Secretary performed this duty, and the responses of Texas will be discussed in comments below. Had the Secretary been more rigorous in the pursuit of his duty to initiate substantive negotiations, other circumstances of the DOE program progress suggest that completion of a written agreement probably could not have been accomplished during the six month period. First, the May 28, 1986, announcement of the President's candidate sites decision, with literally only a few moments prior notice, and the simultaneous issuance of final Environmental Assessments for nomination of sites, left Texas with little to no specific knowledge of DOE's site characterization plans at the time of the candidate site decision. In addition, the land within the Deaf Smith County site is entirely private farmland, and remains as such as this time, without our having knowledge of DOE's specific plans for acquisition during the site characterization process. These two factors put Texas in a position in which it would be undesirable, and impossible to complete a written agreement, as a result of DOE not having made available sufficient information regarding its program plans for us to fully scope the necessary contents of such an agreement.

COMMENT 2

The U. S. DOE report does not fully state the Texas response to the referenced July 26, 1986 letter.

The report states: "Mr. Frishman replied in a telephone conversation with DOE Headquarters staff on August 19, 1986, that a joint meeting between the Department and State and Tribal nuclear waste offices would not be appropriate at this time, although such a meeting might be worthwhile in the future."

The response from Mr. Frishman further stated that the NWPA speaks to a "separate binding agreement" [Section 117(c)], and that prior to any discussion of "scope and parameters of C&C agreements, and talk about provisions that might be in common in all such agreements" (letter of July 25, 1986, Neff to Frishman), the State of Texas and DOE must address issues of particular interest and significance to the unique situation of the Deaf Smith County site in Texas.

The DOE report correctly reflects that there was no further communication of substance on the matter of a written agreement with the State of Texas until the referenced November 20, 1986, letter from Ben Rusche to Governor Mark White, dated just eight days before the close of the statutory six month period.

COMMENT 3

The State of Texas provided timely response to the referenced November 20, 1986 letter.

Upon receipt of the November 20, 1986, letter from Ben Rusche, a December 5, 1986, response was mailed to Mr. Rusche. A copy of that letter is attached to these comments. In that response, the DOE Office of Civilian Radioactive Waste Management designation of a team to initiate negotiations with Texas, led by Mr. Jeff Neff, was acknowledged. We have not been contacted by Mr. Neff on this matter, since his designation as lead negotiator.

COMMENT 4

The DOE's view of the scope of a written agreement, pursuant to Section 117(c) of the NWPA, is unduely restrictive.

The referenced November 20, 1986, letter states, at the end of the second paragraph: "The provisions of such an agreement are defined by the Act." This interpretation of the scope of a written agreement is not supported by the Act, in that the Act [Section 117(c)], when the key language is sufficiently distilled, describes a written agreement as "setting forth (but not limited to) (emphasis added) the procedures under which the requirements ..., and the provisions of such written agreement, shall be carried out." It is our position that the Act does not, nor did the Congress intend for it to "define" the scope and elements of a written agreement. The Act does contain a recognition of the minimum scope of activities for which procedures should be developed, but in no way does it state or imply any limitation other than the necessity that the provisions not be unlawful.

This is a matter of considerable concern to the State of Texas in view of the fact that the Deaf Smith County site is located on private land which includes and is surrounded by thousands of acres of prime farmland that is continually involved in intensive crop, livestock, and seed production. Agriculture is the mainstay of the economy of Deaf Smith County, which consistently ranks first in Texas in cash receipts for crops and livestock, with annual receipts exceeding $500 million. Any written agreement with the State of Texas must take into account this, and other unique aspects of the site area. A preconceived notion, by DOE, of the scope of such an agreement is not only unacceptable to Texas, but is contrary to the letter and intent of the NWPA.

COMMENT 5

The DOE did not provide adequate time for the State of Texas to review and comment on its report and submit the report to Congress within the 30 day statutory period.

The NWPA requires that the Secretary's report to Congress within the 30 days following the initial six month period after candidate site designation, if a written agreement of not completed. The Act further requires that the Secretary's report be submitted to the Governor of the affected state for his review and comments, which comments are to be attached to the Secretary's report.

The DOE report was transmitted by letter from Ben Rusche to Governor Mark White dated December 23, 1986, just five days before the close of the 30 day statutory period. The December 23, 1986, letter seeking our early response is attached to these comments. Clearly, it was not possible for the State of Texas to review and transmit comments on the Secretary's report in a manner that would have permitted the Secretary to submit his report to Congress within the statutory period.

enclosures

OFFICE OF THE GOVERNOR
STATE CAPITOL
AUSTIN, TEXAS 78711

MARK WHITE
GOVERNOR

December 5, 1986

Mr. Ben C. Rusche, Director
Office of Civilian Radioactive Waste Management
United States Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Mr. Rusche:

We have received your letter of November 20, 1986, in which you inform Governor White that Mr. Jeff Neff, manager of the DOE Salt Repository Project Office, will serve as the leader of the DOE negotiating team to begin the process of seeking to develop a consultation and cooperation agreement with the State of Texas, pursuant to Section 117(c) of the Nuclear Waste Policy Act of 1982.

Governor White has asked that I acknowledge your letter and the information that Mr. Neff will be contacting us to discuss appropriate arrangements. Mr. Neff may contact me at the Nuclear Waste Programs Office at his convenience.

Thank you for informing us of your having initiated the C&C agreement process by naming the DOE's team leader for negotiations.

Sincerely,

Steve Frishman, Director
Nuclear Waste Programs Office

SF:dp

Department of Energy
Washington, DC 20585

RR GC

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Honorable Mark White
Governor of Texas
Austin, Texas 78711

Dear Governor White:

Section 117(c) of the Nuclear Waste Policy Act of 1982 (the Act) directs the Department of Energy to submit to Congress a report on the status of negotiations leading to Consultation and Cooperation Agreements, if such agreements are not completed within six months after notification that the sites have been approved for site characterization for a nuclear waste repository. The report must also include the reasons why such agreements have not been concluded. The Act also specifies that affected States and Indian Tribes have an opportunity to review and comment on this report, and their comments are to be included in the Department's submission to Congress.

Enclosed is a copy of the report which I will be transmitting to Congress. In accordance with the Act, which requires that the Department should transmit this report to Congress no later than 30 days after the end of the six-month period following notification of a site, we will be submitting this report to Congress shortly. We would therefore appreciate receiving your comments as soon as possible.

We look forward to working with the State of Texas on consultation and cooperation negotiations.

Sincerely,

Ben C Rusche
Ben C. Rusche, Director
Office of Civilian Radioactive
Waste Management

Enclosure

OFFICE OF THE GOV.
GENERAL COUNSEL
REC'D JAN 0[illegible] 1987
AM 7,8,9,10,1[illegible] [illegible] 3,4,5,6 PM

Report to Congress Concerning Negotiations
with the State of Texas
as Required by
Section 117(c) of the
Nuclear Waste Policy Act of 1982

U.S. Department of Energy

December 1986

Section 117(c) of the Nuclear Waste Policy Act of 1982 (the Act) directs the Department of Energy (DOE) to submit to Congress a report on the status of negotiations leading to Consultation and Cooperation Agreements, if such agreements are not completed within six months after notification that sites have been approved for site characterization by the President for a nuclear waste repository. The report must also include the reasons why such agreements have not been concluded. In accordance with the Act, the Department must seek to enter into these agreements not later than 60 days after Presidential approval of a site for site characterization.

On May 28, 1986, President Reagan approved the Department's recommendation that sites in three States - Nevada, Texas, and Washington - be selected for site characterization. On July 25, 1986, Mr. Jefferson O. Neff, manager of the Salt Repository Project Office, wrote to Mr. Steve Frishman, director of the Texas Nuclear Waste Programs Office, to invite the State to initiate the process of developing a Consultation and Cooperation Agreement with a meeting of representatives of all States, within which recommended sites are located, and all three affected Indian Tribes. Mr. Frishman replied in a telephone conversation with DOE Headquarters staff on August 19, 1986, that a joint meeting between the Department and State and Tribal nuclear waste offices would not be appropriate at this time, although such a meeting might be worthwhile in the future.

In response to this interest in individual negotiations, on November 20, 1986, a letter was sent to Governor Mark White of Texas to renew the Department's offer to negotiate a Consultation and Cooperation Agreement, this time directly between DOE and the State of Texas. Although a response from Governor White has not yet been received, the Department is looking forward to working with the State of Texas to pursue negotiations on a Consultation and Cooperation Agreement.

Pursuant to the Act, enclosed are the comments of Governor White on this report. Also enclosed is a copy of the July 25, 1986, letter to Mr. Frishman and a copy of the November 20, 1986, letter to Governor White.

Enclosures

Department of Energy
Chicago Operations Office
Salt Repository Project Office
505 King Avenue
Columbus, Ohio 43201-2693
Commercial (614) 424-5916
F.T.S. 976-5916

July 25, 1986

Mr. Steve Frishman
Nuclear Waste Program Office
Office of the Governor
General Counsel Division
P.O. Box 12428
Austin, TX 78711

Dear Mr. Frishman:

On May 28, 1986, the Department of Energy's recommendation of three sites in Nevada, Texas, and Washington was approved for detailed site characterization for a deep-minded geologic repository for high-level waste and spent nuclear fuel.

In accordance with Section 117(c) of the Nuclear Waste Policy Act of 1982, the Department desires to begin the process that would eventually lead to a signed Consultation and Cooperation (C&C) agreement.

As a starting point, the Department would like to meet with representatives from the three States and three affected Indian Tribes to discuss C&C activities to date, review the scope and parameters of C&C agreements, and talk about provisions that might be in common in all such agreements.

We will be contacting you in the near future to arrange for a time and place that would be acceptable to each of the States and Indian Tribes. Should you desire to discuss this matter with me, please do not hesitate to give me a call.

Sincerely,

J.O. Neff

J.O. Neff
Project Manager
Salt Repository Project Office

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IN#471-86

FROM BPMD MDC COLS. 07/28/85 09:41 P. 1

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Fax Number 252-9608
Verify Number 252-9761

Department of Energy
Washington, DC 20585

NOV 20 1986

Honorable Mark White
Governor of Texas
Austin, Texas 78711

Dear Governor White:

On May 28, 1986, President Reagan approved the Department of Energy's (DOE) recommendation of three sites in Nevada, Texas, and Washington for detailed site characterization for a deep-mined geologic repository for high-level radioactive waste and spent nuclear fuel.

In accordance with Section 117(c) of the Nuclear Waste Policy Act of 1982 (the Act), not later than 60 days following such approval the Department was required to seek to enter into negotiations leading toward consummation of a written binding consultation and cooperation agreement. The provisions of such an agreement are defined by the Act.

On July 25, 1986, Mr. Jeff Neff, project manager of the Salt Repository Project Office at DOE's Chicago Operations Office, wrote to Mr. Steve Frishman of your staff recommending that we initiate the process of developing consultation and cooperation agreements with a meeting of representatives of all States, within which recommended sites are located, and of all three affected Indian Tribes. Similar letters were sent by our project offices to the other two States and to the three affected Indian Tribes.

We learned from the States and Indian Tribes that negotiations between the Department and the individual State and Tribal nuclear waste offices might prove more fruitful than a general meeting. Therefore, I am renewing the offer to initiate negotiations for a consultation and cooperation agreement, this time between DOE and the State of Texas.

To facilitate the commencement of negotiations, the Office of Civilian Radioactive Waste Management has designated a team to negotiate with your State. This team will be led by Mr. Neff, who will be contacting your office shortly to discuss appropriate arrangements.

We look forward to the participation of the State of Texas in this important statutory process.

Sincerely,

Ben C Rusche

Ben C. Rusche, Director
Office of Civilian Radioactive
Waste Management